

Most of the labels give Troy as the locality but Albany, Fort Erie, Fort Oswego, New York City, Salina, Schenectady, and Scaighticoke are also included. The months range from April to October. The system of numbers corresponds to that used in the several editions of Eaton's Manual. The system includes the class and order of Linnaeus' artificial system, the natural order of Linnaeus, and the order of Jussieu. The latter also appears on the back of each specimen apparently as an aid in filing as recommended by Eaton. The names of the plants correspond to those of the seventh edition of the Manual published in 1836.

One of the following names—Houghton, Stevenson, Wright, and Fox—appears on about half the labels. All but Fox are mentioned specifically in both the sixth and the seventh editions of the Manual as correspondents whose opinion Eaton followed on matters of distribution. Wright doubtless refers to Dr. John Wright who assisted in the preparation of the eighth edition of the Manual. It seems likely that these men collected the specimens although the labels were written by Eaton. Houghton's name is spelled incorrectly in one instance which indicates that he did not make the label. This together with the more positive fact that the labels are in Eaton's handwriting make it reasonable to suppose that the specimens were in Eaton's possession.

The date, the localities, the correspondents, the system of numerals, and most important, the handwriting all give evidence that the plants were actually Eaton's.

Professor Bray was kind enough to loan the folio for exhibition at Williams during the Mark Hopkins Centenary. It has been returned to him and may be consulted at the Biological Laboratories at the Rensselaer Polytechnic Institute.

WILLIAMS COLLEGE.

ARABIS IN EASTERN AND CENTRAL NORTH AMERICA

MILTON HOPKINS

(Continued from page 148)

12. *A. VIRIDIS* Harger. Biennial from a spreading tap-root: stem 2–5 dm. high, branched at base or above or more rarely simple, leafy, averaging 25 internodes to the first flower, glabrous throughout, (pubescent in the var.) bright green: radical leaves rosulate, lanceolate

to spatulate, those of the first year dentate to laciniate, glabrous, persistent, those of the second year strongly laciniate to lyrate-pinnatifid, glabrous on both surfaces, 2–9 cm. long, 5–15 mm. broad, petioled, the petioles glabrous; cauline leaves imbricate, numerous, appressed to subappressed, 1–8 cm. long, 3–15 mm. broad, the lowermost lanceolate and strongly laciniate or very rarely lyrate-pinnatifid, the middle ones lanceolate to linear-lanceolate and laciniate or dentate, the uppermost smaller, lanceolate to linear, subentire to dentate, all cauline leaves glabrous, sessile with a sagittate base, acute to subobtuse: flowers in close, compact racemes; flowering pedicels strictly erect, never divergent, glabrous, averaging at anthesis 3–8 mm. long; sepals linear-oblong, membranaceous, glabrous, acuminate, 3–5 mm. long, nearly one-half the length of the petals; petals creamy-white to yellowish-white, 6–8 mm. long, spatulate to oblanceolate: siliques at first erect, soon becoming falcate-arcuate, recurved, 6–9 cm. long, 1.75–2 mm. broad, glabrous, one-nerved to the middle and often two-thirds their length; fruiting pedicels erect or ascending, glabrous, 6–10 mm. long; stigma small, round, on a short style 0.75–1 mm. long or very rarely sessile; seeds in one row in the pod, broadly elliptical to quadrate-oblong, 1.5–1.8 mm. long, averaging 1 mm. broad, winged all around, the wing averaging 0.33–0.5 mm. broad.—Represented by two geographical varieties.

Stem, radical and cauline leaves and pedicels quite glabrous var. *typica*.
 Stem, radical and cauline leaves and pedicels pubescent with
 short, stiff hairs var. *Deamii*.

Var. **typica**.—*Arabis viridis* Harger in RHODORA, xiii. 37 (1911); Britton & Brown, Ill. Fl. ed. 2: ii. 181 (1913); Taylor in Mem. N. Y. Bot. Gard. v. 348 (1915). *A. laevigata* var. β *laciniata* T. & G., Fl. N. Am. i. 82 (1838); Britton, Man. 464 (1901).—Cliffs, ledges or rocky woods, New England, eastern New York and eastern Pennsylvania, with an isolated station in Georgia; Michigan; southern Missouri, northwestern Arkansas and Oklahoma. The following are characteristic. MAINE: crevices of cliffs at the Gulf, South Berwick, *Parlin*, no. 1,114; on cliffs, local, South Berwick, *Parlin & Fernald*, no. 669. NEW HAMPSHIRE: summit of East Rattlesnake Mt., Holderness, Asquam Lake, *Svenson*, 24 July 1921. VERMONT: shaded slaty talus, Ira, Rutland Co., *Pease*, no. 23,976; Twin Mountains, West Rutland, *W. W. Eggleston*, no. 1,030. MASSACHUSETTS: wet cliffs at Cascade, Melrose, *W. P. Rich*, 11 June 1892; Bearberry Hill, Stony Brook Reservation, *E. F. Williams*, 30 May 1897; in seams of low cliffs, Horn Pond Mt., Woburn, *A. H. Moore*, no. 2,697; Bussey's Hill, Boston, *C. E. Faxon*, 31 May 1878; north bank of Connecticut River, Gill, *St. John & Weatherby*, 11 May 1912; trap ledges, Miller's Falls, Montague, *Fernald*, 13 May 1911; Granby, *Floyd*, 21 May 1915; common on trap ledges, Holyoke diabase, Mt. Tom, Hampshire Co., *Forbes & Wheeler*, 17 May 1913; among rocks of Devil's Garden, Holyoke Range, *T. O. Fuller*, 30 May 1887. RHODE ISLAND: Johnston, *J. W. Congdon*, 9

May 1878 [NY]. CONNECTICUT: dry crevices of trap cliff, Southbury, *Harger*, no. 5,322 (TYPE); Wethersfield, *C. Wright*, 1878; valley of Farmington River, Tariffville, *Winslow & Hill*, 17 May 1913; dry woods, South Britain, *Woodward*, 31 May 1909; dry top of Mt. Carmel, Hamden, New Haven Co., *Blewitt*, no. 3,476; in crevices and thin soil on trap ridges in half shade, Southbury, *Harger*, Pl. Exsicc. Gray. no. 458. NEW YORK: thin soil in rocks, southern slope of Peaked Mt., southern W. Fort Ann, *Burnham*, 16 June 1918; rocky places, Delph Pond, west of Comstocks, Washington Co., *Burnham*, 19 June 1900; rocky woods, Glenmont, Albany Co., *House*, no. 7,872; on cliffs, Snake Hill, Saratoga Lake, *Muenschler & Lindsey*, no. 3,335 [Mo]; Troy, *H. H. Eaton*, June 1817 [Phil].



MAP 24. Range of *ARABIS VIRIDIS*, var. TYPICA.

PENNSYLVANIA: dry wooded slope along Schuylkill River, Linfield, Montgomery Co., *Long*, no. 11,688 [Phil]. GEORGIA: Kennesaw Mt., *R. N. Larrabee*, 16 May 1885; large knob, Kennesaw Mt., Cobb Co., *L. M. Perry & L. C. Meyers*, no. 913. MICHIGAN: Muskegon, *C. D. McLouth*, 17 May 1896 (as *A. confinis*). MISSOURI: rocks, Iron Co., *Eggert*, 12 April 1893 (as *A. confinis*) [Mo]; in crevices of granite along Black River near Monterey, Reynolds Co., *Drouet*, no. 333; Shannon Co., *Bush*, no. 27 (as *A. hirsuta*) [US]; upland woods near Jack's Fork of Current River, Texas Co., *Steyermark*, no. 18,580; rocky woods, Dexter, Stoddard Co., *E. J. Palmer*, no. 14,773 [Mo]; two miles north of Pickle, St. Genevieve Co., *Steyermark*, no. 1,271 [Mo]; limestone ledges, wooded bluffs, near Galena, Stone Co., *E. J. Palmer*, no. 17,232 [Mo]. ARKANSAS: rocky barrens, Eureka Springs, Carroll Co., *E. J. Palmer*, no. 5,614 [Mo]; along sandstone bluffs near Midway, Sebastian Co., *E. J. Palmer*, no. 33,284 [Mo]; Mulberry Creek, Crawford Co., *D. Demaree*, no. 6,387 [US]; bluffs at Mulberry, Crawford Co., *D. Demaree*, no. 6,408 [US]. OKLAHOMA: vicinity of Fort Sill, Comanche Co., *Mrs. J. Clemens*, no. 11,597. *Fl.* May–July; *fr.* June–Sept. MAP 24.

Var. **Deamii**, n. var., caule pubescente pilis brevibus rigidisque; foliis radicalibus caulisque hirsutis vel glabris. *A. laevigata* var. *heterophylla* Farwell in Rep. Mich. Acad. Sci. xix. 248 (1917) as to description but not as to source of name, *A. heterophylla* Nutt.—Northern Indiana, southern Michigan, eastern Wisconsin and locally in eastern Missouri. INDIANA: dry sandy soil in the woods on east side of Lake James, Steuben Co., *Deam*, no. 20,247 [Deam]; sandy black-white oak woods 5 miles west of South Bend, St. Joseph Co.,



MAP 25.
Range of
ARABIS VIRIDIS,
VAR. *DEAMII*.

Deam, no. 36,351 [Deam]; on cleared gravelly slope on east side of the old tamarack bog, 5 miles east of La Grange, La Grange Co., *Deam*, no. 36,370 (TYPE in Herb. Gray); in sandy black oak woods, 1 $\frac{1}{8}$ mi. southeast of Mongo, La Grange Co., *Deam*, no. 40,698 [Deam], all as *A. hirsuta*. WISCONSIN: Killy Lake, Oconto Co., *J. J. Davis*, 2 July 1915 [Wisc]; Mosinee, *J. J. Davis*, 21 June 1919 [Wisc]; east of Keshena, Oconto Co., *E. E. Honey*, 5 July 1934 [Wisc]. MISSOURI: along wooded bluffs of creek, Howe's Mill, Dent Co., *E. J. Palmer*, no. 34,950 [Mo].
MAP 25.

This plant is most easily mistaken for *A. laevigata*, chiefly due to the fact that the habits are very similar. The pods are recurved and arcuate to subarcuate; at first glance the leaves and flowers are similar and the seeds are essentially identical. But thorough examination reveals distinct differences which may best, perhaps, be observed in comparative form as follows:

A. viridis: Very leafy, averaging 25 internodes to the first flower. Cauline leaves smaller than those of *A. laevigata*, varying from 1–8 cm. long and appressed or subappressed to the stem. Basal leaves of the first year quite glabrous, those of the second year lacinate to lyrate-pinnatifid. Flowers in very close and compact racemes, the petals considerably longer than the sepals. Pods one-nerved rather prominently to the middle and often beyond.

A. laevigata: Less leafy, averaging 13 internodes to the first flower. Cauline leaves larger than those of *A. viridis*, varying from 3–20 cm. long and spreading or ascending but never closely appressed to the stem. Basal leaves of the first year always densely to sparingly pilose with short, simple hairs, never glabrous, those of the second year merely dentate to sharply serrate, but never lacinate or lyrate-pinnatifid. Flowers in long, loose racemes, the petals scarcely exceeding the sepals in length. Pods faintly one-nerved at the base or very rarely to the middle but never beyond it.

In flowering condition *A. viridis* suggests *A. Drummondii*, having the close, compact racemes of that species, and the more or less strict cauline leaves and flowers. But in *A. Drummondii* the petals are usually roseate instead of creamy-white, and in fruit the two are quite distinct, the latter having strict and appressed siliques while the former has them spreading and recurved. *A. Drummondii* has basal leaves merely dentate whereas *A. viridis* has them lyrate-pinnatifid or lacinate.

It seems highly probable to me that *A. laevigata* var. *laciniata* Torrey & Gray¹ is simply *A. viridis*, but unfortunately they cited no

¹ Torrey & Gray, Fl. N. Am. i. 82 (1838).

type nor did they give any information relative to its range. One is led to assume, consequently, that it is found wherever one finds typical *A. laevigata*, and that it was considered by them as merely a leaf-form of that species. But the cauline leaves of that plant are only seldom saw-toothed and are never laciniate, whereas in *A. viridis* they are decidedly so. Without a type-sheet for examination one can only surmise as to the identity of this variety. On page 82 of the copy of Torrey & Gray's *Flora* in the Library of the Gray Herbarium, Watson pencilled after *A. laevigata* var. *laciniata* "*A. heterophylla* Nutt!", but one can hardly reconcile oneself to an admission that such is the case, inasmuch as the above authors, copying Nuttall's manuscript, explicitly describe *A. heterophylla* "Radical leaves somewhat pilose with simple hairs."¹ The first year's basal leaves of *A. viridis* are quite glabrous in every specimen which I have examined, while those of *A. laevigata* are without exception pilose with short and simple hairs (although those of the second year are glabrous); it therefore appears that *A. heterophylla* Nutt. (the type specimen of which I have not yet been able to find) and *A. laevigata* var. *laciniata* T. & G. are *not* identical.

A. viridis is found locally in eastern New England, where it is rather rare, but becomes more common on the trap ledges and cliffs of the Connecticut Valley of Massachusetts, and in Connecticut, Vermont and New York. From Pennsylvania I have seen only one specimen (from Montgomery County) and it appears isolated in Cobb County in northern Georgia with, so far as I have been able to learn, no intermediate stations. In Michigan it is extremely local, is apparently absent from Indiana, at least in the typical form, but becomes common in Missouri, from which state I have seen more specimens than from any other. In northeastern Arkansas it does not appear to be a rarity, but it is isolated in the Wichita Mountains of southwestern Oklahoma. One should watch for it in extreme eastern Oklahoma and in Indiana, as well as in Ohio and in the states between Pennsylvania and Georgia. Despite the gaps in its range, it is clearly a plant of Alleghenian and Ozarkian distribution.

Var. *Deamii* is characterized by a pubescence which is found on the stem, on the basal and cauline leaves and on the flowering and fruiting pedicels. The hairs on the stem are short and stubby, but on the leaves they are a millimeter or more in length and give a hispid ap-

¹ T. & G., l. c.

pearance to these parts. Mr. C. C. Deam, being unfamiliar with *A. viridis* from Indiana, identified his specimens as "*A. hirsuta*" and pointed out to me the fact that the basal leaves were strongly laciniate and lyrate-pinnate. The flower and fruit of his specimens show no relation to *A. pycnocarpa* ("*A. hirsuta*") but in every character are a perfect match for *A. viridis*. The habit of the Indiana specimens exactly fits that of *A. viridis*, and there seems to be no question as to their specific identity with it.

In 1917, Farwell described a plant which he collected in Michigan¹ as *A. laevigata* var. *heterophylla*, his combination being doubtfully based on Nuttall's *A. heterophylla*. Although I have not examined Farwell's specimen, his description strongly suggests that it is *A. viridis* var. *Deamii*. Since I am interpreting it as resting *nomenclaturally* in part on *A. heterophylla* Nutt. and, consequently, a mixture, it seems unwise to perpetuate the confusion by taking up the ambiguous name *heterophylla* for the pubescent variety. I am, therefore, giving an unequivocal name.

13. *A. LAEVIGATA* (Muhl.) Poir. Biennial from a somewhat branched tap root: stems 3–9 dm. high, branched at base and above or simple, glabrous and strongly glaucous throughout, averaging 13–15 internodes to the first flower: basal leaves rosulate, soon disappearing, spatulate-obovate to narrowly oblanceolate, those of the first year sparingly pilose with short simple hairs, those of the second year entirely glabrous, dentate to serrate, 3–11 cm. long, 0.5–2.5 (–3) cm. broad, acute to subacuminate, petiolate; cauline leaves oblong-lanceolate to linear, spreading to subappressed, imbricate, 3–20 cm. long, 3–15 mm. broad, sessile with a sagittate or sometimes auriculate base, glabrous throughout, serrate-dentate to entire, acute to obtuse or somewhat acuminate: flowers small, in long, loose racemes; flowering pedicels ascending, often divergent, glabrous, 5–9 mm. long, at anthesis; sepals membranaceous, greenish, 2.5–4.5 mm. long, nearly the length of petals, glabrous, spatulate to oblong; petals white, 3–5 mm. long, spatulate to oblanceolate: siliques irregularly downward-curved to subarcuate or more rarely slightly straightish, ascending in youth, recurved-spreading at maturity, compressed, attenuate, glabrous, faintly one-nerved below the middle or only toward the base, 5–10 cm. long, 0.75–2.5 mm. broad; fruiting pedicels ascending, divergent, glabrous, 7–14 mm. long at maturity; style 0.5–1 mm. long or very rarely the stigma subsessile; seeds in one row, quadrate to oblong, averaging 1 mm. long, 0.5 mm. broad, winged all around.—Encycl. Suppl. i. 411 (1810) as "*levigata*"; DC. Syst. ii. 237 (1821); DC. Prod. i. 147 (1824); Hooker, Fl. Bor.-Am. i. 43 (1829); Beck,

¹ Farwell in Rep. Mich. Acad. Sci. xix. 248 (1917).

Bot. N. & M. States, 30 (1833); T. & G. Fl. N. Am. i. 82 (1838); Torrey, Fl. N. Y. i. 55 (1843); Eaton & Wright, N. Am. Bot. ed. 8: 131 (1840); Wood, Classbk. Bot. 39 (1845) as "*laevigata*"; Gray, Man. 36 (1848); Chapman, Fl. S. U. S. 28 (1860); Watson in Gray, Synop. Fl. N. Am. i. 162 (1895); Britton & Brown, Ill. Fl. ii. 149 (1897); Britton, Man. Fl. 464 (1901); Robinson & Fernald in Gray, Man. ed. 7: 438 (1908); Rydberg, Fl. Pr. & Pl. 382 (1932); Small, Man. Se. Fl. 572 (1933). *Turritis laevigata* Muhl. Index Fl. Lancastr. in Trans. Am. Phil. Soc. iii. 173 (1793) nomen only, and in Willd. Sp. Pl. iii¹. 543 (1801); Persoon, Synop. ii. 205 (1807); Pursh, Fl. Am. Sept. ii. 438 (1818); Rees, Cycl. xxxvi. no. 2. (1819). *Turritis lyrata* Raf. in Am. Monthly Mag. ii. 44 (1817). *Arabis pendula* Nutt. Genera. ii. 70 (1818), non Linnaeus, Sp. Pl. ii. 665 (1753). *Arabis pendula* var. β DC. Syst. ii. 236 (1821). *Arabis lyrifolia* DC. Syst. ii. 244 (1821). *Arabis heterophylla* Nutt. ex. Torr. & Gray, Fl. N. Am. i. 81 (1838); Eaton & Wright, N. Am. Bot. ed. 8: 131 (1840); Walpers, Rep. i. 133 (1842); Dietrich, Synop. iii. 693 (1843); Wood, Classbk. ed. 2: 166 (1847); Gray, Man. 36 (1848). *Arabis hastata* Eaton, Man. Bot. ed. 2: 141 (1818). *A. laevigata* var. *heterophylla* (Nutt.) Farwell in Rep. Mich. Acad. Sci. xix. 248 (1917) as to name-bringing synonym but not as to plant described.—Rich rocky woods, rocky hillsides and ledges, southwestern Quebec to South Dakota, south to Georgia, Alabama, Arkansas and Oklahoma. The following are characteristic. QUEBEC: dry rocky woods, limestone, Philipsburg, Missisquoi Co., C. H. Knowlton, Aug. 10–11, 1923 (as *A. Drummondii*). NEW HAMPSHIRE: Hinsdale, Kennedy, 29 Aug., 1907; Nottingham, Rockingham Co., A. A. Eaton, no. 444; Walpole, Cheshire Co., R. W. Woodward & L. A. Wheeler, May 25, 1917. VERMONT: Mt. Philo, Charlotte, Kennedy, 9 July, 1908; Gardner's Island, Lake Champlain, C. E. Faxon, Aug. 7, 1880; Castleton, Rutland Co., Eggleston, Aug. 2, 1903. MASSACHUSETTS: dry rocky wooded hillsides, Middlefield, Hampshire Co., Fernald & Long, no. 9,568; lime cliffs and outcrops, Sheffield, Berkshire Co., J. A. Cushman, no. 600. CONNECTICUT: trap ridge, Southbury, Harger, 29 May, 1908; on trap ledges, North Guilford, G. H. Bartlett, 20 May 1906; rich woods, Stratford, E. H. Eames, 9 June 1901. NEW YORK: rocks, south side Portland Point Ravine, Lansing, Gershoy, no. 6,537; rich shaded ravine slope, Enfield Ravine, $\frac{1}{2}$ mi. below falls, Enfield, Wiegand, no. 8,221; dry rocky woods above falls, Taughannock Ravine and vicinity, Ulysses, Tomkins Co., A. J. Eames, no. 4,219; rocky bank of Hudson River Big Hollow, Hudson Falls, Washington Co., S. H. Burnham, 10 June 1890. NEW JERSEY: Ramapo, C. W. Hall, 8 May 1876 [Bklyn]; Rocky Hill, Lighthipe, 15 May 1884 [Bklyn]; rocky woods, Hamburg, W. M. Van Sickle, 3 May 1892 [Bklyn]. PENNSYLVANIA: moist rocky wooded slopes along Delaware River, New Hope, Bucks Co., St. John & Long, no. 2,313; steep wooded slopes, Edison, Bucks Co., Fogg, 27 May 1923; on the Conestoga River, south of Lancaster, Lancaster Co., Heller, May 5,

1900. DELAWARE: rocky woods, Wilmington, *A. Commons*, 8 May & 16 Aug. 1897; shaded hillside along Brandywine, Granogue, *A. Commons*, 15 May & 24 Aug. 1896 [Phil]. MARYLAND: Harper's Ferry Heights, *S. Watson*, 17 April 1890; rocky wooded slopes along Susquehanna River, Bald Friar, Cecil Co., *St. John & Long*, no. 1,010; rocky woods, Cabin John Bridge, Montgomery Co., *Pease*, no. 7,403; wooded hillsides, Glen Echo, Montgomery Co., *J. H. Painter*, no. 1,317 [Mo]. DISTRICT OF COLUMBIA: rich ground on Potomac River, *Morong*, May 1877; ad vias, frequens prope Washington, *T. Holm*, April & Sept. 1888; hillsides, *Steele*, 16 April 1897. VIRGINIA: Bedford Co., *Curtiss*, 1 May 1887; Natural Bridge, *G. G. Kennedy*, 7 May 1887; on rocks, Difficult Run, vicinity of Great Falls, *Killip*, no. 7,418; about Mt. Crawford, Rockingham Co., *Heller*, May 5-13, 1893. WEST VIRGINIA: Snowy Mt., Pendleton, *Rydberg*, no. 9,064 [NY]; wet rocks, Morgantown, *Millspaugh*, no. 12 [NY]; New Creek, Hampshire Co., *J. D. Smith*, 28 June 1880 [US]; Upshur Co., *Pollock*, 24 May 1897 [Mo]; Lewis Co., *Pollock*, 24 April 1897 [US]. NORTH CAROLINA: rich ravines, Great Smoky Mts., Swain Co., *Beardslee & Kofoid*, 5 Aug. 1891; woods, Linville, Avery Co., *F. W. Hunnewell*, 21 July 1933; Catawba River, near Morgantown, *M. E. Hyams*, April 1897 [NY]. GEORGIA: cliffs of Coosa River, near Rome, *Canby*, no. 7; Stone Mt., Dekalb Co., *Small*, May 1-18, 1895 [NY]; Rome, *Ravenel* [Mo]; Cave Spring, *C. Mohr*, June 1881 [US]; Stone Mt., *Biltmore Herb.*, no. 1,033 [Phil]. ONTARIO: rocky woods, Talbot's Woods, Elgin Co., *Macoun*, no. 141; rocky woods along streams, Picton, *Macoun*, no. 1,722 [Can]; dry or rocky margins of woods, Port Stanley, Lake Erie, *Macoun*, no. 1,723 [Can]. MICHIGAN: Detroit, *Glatfelter*, 5 Aug. 1898 [Mo]; near Lansing, *L. H. Bailey*, 25 May 1888; moist wooded slopes west of Ann Arbor, *Ehlers*, no. 2,815 [Phil]; near Port Huron, *C. K. Dodge*, 13 May & 15 July 1894; Huron R., *Mosely*, 30 May 1893 [Mo]. OHIO: near Cincinnati, *C. G. Lloyd*, 17 April 1882; Cleveland, *I. J. Hicks* [Mo]; rocky soil, N. Amherst, Lorain Co., *Webb*, no. 5,255; rich wooded hillsides north of Columbus, *Gleason*, 13 May 1905; south of Swanton, Fulton Co., along Wabash R. R., *Mrs. R. Engle*, 4 July 1927 (as *A. brachycarpa*). INDIANA: wooded slopes of the Millport Hill about 11 miles north of Salem, *Deam*, no. 23,233; wooded base of bluff of Ohio River about 6 miles east of Cannelton, *Deam*, no. 24,963 [Deam]; wooded bluff of stream near Lake Michigan, Tremont, *F. W. Johnson*, nos. 1,729 & 1,804 [NY]. KENTUCKY: Boone Creek, Fayette Co., *W. A. Anderson*, no. 423; Shelbyville, *Miss M. B. Flint*; Elkhorn Cliff, Stamping Ground, *J. W. Singer*, no. 23 [US]; Blue Lick Hills in early spring, near Lexington, *Short*; High Bridge, banks of Kentucky R., *F. T. McFarland*, no. 20 (as *A. Drummondii*) [US]. TENNESSEE: wet limestone bluffs, Turnbull Creek, Kingston Springs, *Svenson*, no. 7; rich woods, Knoxville, *Ruth*, nos. 1,940 & 234 [NY]; bluffs on Tennessee River, Knox Co., *Kearney*, 3 April 1893 [NY]; Cumberland Mts., Franklin Co., *Eggert*, 6 May

1898 [Mo]; vicinity of Knoxville, *Lamson-Scribner*, April 1890 [US]. ALABAMA: Havana Glen, *L. M. Underwood*, May 1896 [NY]; Florence, *C. M. Wilson*, 5 April 1893 [US]; rocky banks, Warnock Mt., *Mohr*, 12 May 1898 [US]. WISCONSIN: moist hillside, Ferry Bluff, *F. H. Smith*, nos. 23 & 200; moist hillside, Pewitt's Nest, *F. H. Smith*, no. 8; Egg Harbor, Door Co., *Schuette*, 6 July 1882 [US]. ILLINOIS: on rocks in shady ravines, The Sag, *Greenman*, no. 3,601; alluvial woods by Sangamon River, White Heath, Piatt Co., *Pease*, no. 13,421; rich shady woods, Grand Tower, *Gleason*, 5 May 1902; wooded hillside, Urbana, *Gleason*, no. 2,364. MINNESOTA: Fort Snelling, *E. A. Mearns*, 16 June 1891 [US]; Center City, *B. C. Taylor*, June 1892 [US]; Winnebago Valley, Houston Co., *W. A. Wheeler*, no. 154 [Minn]. IOWA: Bentonsport, *E. W. Graves*, no. 1,786½ [Mo]. MISSOURI: on bluffs, Noel, *Bush*, no. 5,753; Montier, *Bush*, no. 31 (as *A. brachycarpa*); low woods, Centerville, *E. J. Palmer*, no. 1,724; woods, Williamsville, Wayne Co., *Eggert*, 17 May 1893 [Mo]; banks of Cuivre R., near Old Monroe, St. Charles Co., *J. Davis*, no. 7,232 [Mo]. ARKANSAS: sandy creek banks, northwest Arkansas, *F. L. Harvey*, no. 23; Benton Co., *E. N. Plank*, 1899 [NY]; along wooded sandstone bluffs of river near Shirley, Van Buren Co., *E. J. Palmer*, no. 33,208 [NY]. OKLAHOMA: gravelly mountainside, near Cache, Comanche Co., *G. W. Stevens*, no. 1,341T; Sapulpa, *Bush*, no. 1,018 [Mo]. COLORADO: Buena Vista, *E. T. Harper*, May 1886 [Wisc]. *Fl.* late April–July; *fr.* June–Sept.

Var. **BURKII** Porter. Cauline leaves linear to linear-lanceolate, entire to subdenticulate, sessile, not amplexicaul; siliques one-nerved at least to the middle and often slightly beyond.—Porter in *Bull. Torr. Bot. Club.* xvii. 15 (1890); Watson in Gray, *Synop. Fl. N. Am.* i. 162 (1895); Britton & Brown, *Ill. Fl.* ii. 149 (1897); Britton, *Man.* 464 (1901); Robinson & Fernald in Gray, *Man.* ed 7: 438 (1908). *Arabis serotina* Steele in *Contr. U. S. Nat'l. Herb.* xiii. 365 (1911). *A. Burkii* Small, *Man. Fl. Se. U. S.* 572 (1933).—Dry hillsides or bluffs, Pennsylvania to North Carolina. The following are characteristic. PENNSYLVANIA: Saw Mill R., lower St. Clair Township, Allegheny Co., *J. A. Shafer*, no. 1,268 [Phil]; Mercersburg, Franklin Co., *Isaac Burk*, 1852 (TYPE in Herb. Phil. Acad. ISOTYPE in Herb. Gray); Harrisburg, *I. Burk*, May–June, 1867; Dauphin Co., *I. Burk*, 1865. VIRGINIA: vicinity of Millboro, Bath Co., *Steele*, 3 Sept. 1906 [Gray], and 21 Aug. 1907 (type of *A. serotina* in U. S. Nat'l. Herb.); shale banks near New Market, Massanutten



MAP 26.
Range of
ARABIS LAEVI-
GATA, var.
BURKII.

Mts., Shenandoah Co., *Lena Artz*, 15 July 1935; Massanutten Mts., Shenandoah Co., *L. Artz*, 8 Aug. & 29 Sept. 1935. WEST VIRGINIA: Roanoke R., south of Roanoke, *Small & Heller*, no. 443 [Amh]; in precipitous woods along Wheeling Creek, 8 miles east of Wheeling, *A. MacElwee*, 18 May 1909 [Phil]; North Fork Mt., Pendleton Co.,

P. D. Strausbaugh, 24 June 1932 [Minn.]. NORTH CAROLINA: rocks, Hot Springs, Madison Co., *Churchill*, 5 June 1899. MAP 26.

Willdenow described *Turritis laevigata* (ascribed to Muhlenberg in litt.) as having erect siliques.¹ Unfortunately, Muhlenberg sent it to Willdenow under a manuscript name, although he had already written a description for it in his manuscript *Florula Lancastriensis*,² an Index to which was printed in the third volume of the Transactions of the American Philosophical Society for the year 1793, and on page 173 of which the name was duly published without a description. But this *T. laevigata* of the Index is merely a nomen; the description of Willdenow is the first published one to which we may refer.

An excellent tracing of the Muhlenberg type in the Willdenow Herbarium at Berlin is in the Gray Herbarium and it shows all the characteristic features of *Arabis laevigata* as generally understood. The basal leaves of the first year's growth are typical, even to an attempt to reproduce in ink the pilose pubescence; the cauline leaves match in every detail those of our plant; the flowers are in every way typical, while the siliques, so young that the sepals and petals still remain on the flower, are at the stage when it would be quite impossible to say whether they were erect or pendulous. The fruit of this species does not normally become deflexed until just at or slightly before the seeds mature, and any attempt to predict their direction before this period would lead only to the conclusion that they were erect.

This emphasis of Willdenow's on erect siliques caused considerable confusion among subsequent taxonomists. DeCandolle in both the *Systema* and the *Prodromus* describes the plant "siliquis erectis," but according to Torrey & Gray, "The description of DeCandolle was drawn from a dwarf specimen, without fruit, in Pursh's herbarium."³ Pursh, however, omits all mention of the siliques in the description in his *Flora of North America*. Hooker describes the plant "siliquae quite erect, 1½ inches long, linear, plane, tapering at the extremity into a very short style"⁴ to which Torrey & Gray reply: "*T. laevigata* [Hooker publishes the name quite clearly as *A. laevigata*], Hook. fl. Bor.-Am. i. p. 43, must be a very different plant from the one here described [*A. laevigata*],"⁵ but about which they expressly say "siliques

¹ Willdenow, *Species Plantarum*. iii¹. 543 (1801).

² Muhlenberg, *Florula Lancastriensis*, i. 483 (ined.).

³ Torrey & Gray, *Fl. N. Am.* i. 82 (1838).

⁴ Hooker, *Fl. Bor.-Am.* i. 43 (1829).

⁵ T. & G. l. c.

linear, narrow & elongated, recurved-pendulous." In view of the facts that the siliques of *A. laevigata* do not become pendulous or subpendulous until reasonably late in their development and that the fruiting pedicels are always ascending, the descriptions of Hooker and DeCandolle may satisfactorily be attributed to the fact that they saw plants in very young fruit—as did Willdenow.

That the *T. lyrata* of Rafinesque is merely the plant under discussion seems entirely probable from his description,¹ although the actual identity of it is not known. The "narrow, compressed, and sickle shaped" siliques are characteristic of *A. laevigata*, as is also the "smooth stem." The only other plants which Rafinesque might have had in mind are *A. canadensis* and *A. viridis*, but the former does not fit his description, possessing a pubescent stem, at least at the base, and being further characterized by siliques which are anything but "narrow," measuring well over 2.5 mm. broad at their narrowest point, and the latter, although having "radical leaves spreading lyrate obtuse" has not, to the best of my knowledge, been found in the Catskill Mountains, the habitat of Rafinesque's *T. lyrata*.

A. laevigata grows on basic or circumneutral ledges and bluffs or in rocky woods from the southernmost part of Quebec, just above the Vermont-New Hampshire line, and western New England, across the northern United States and southern Ontario, and is reported as far west as the Dakotas (although I have seen no specimens from those states). In a southerly direction it reaches Georgia and northern Alabama (no record of its existence in Mississippi seems available) and is reported westward as far as Oklahoma, Kansas and Nebraska, although from the last two states I have not examined any specimens.

According to its habitat, the size of the plant and luxuriance of its foliage varies considerably. The cauline leaves range from 3 to 20 cm. long with accompanying extremes in width. On luxuriant specimens the siliques are very numerous and crowded, as well as very long, whereas in dwarfed and depauperate plants there may be as few as 12 or 15 on an entire raceme. The margins of the stem-leaves vary from sharply serrate to subentire, and not infrequently some of the upper-

¹ Rafinesque in the American Monthly Magazine, ii. 44 (1817). The description reads as follows: "*Turritis lyrata*. Smooth, stem striated very simple; radical leaves spreading lyrate obtuse, and with obtuse teeth, stem leaves erect sessile acute, the lower ones oblong with acute teeth, the upper ones lanceolate entire; peduncles shorter than the flowers, petals entire, siliques narrow, compressed and sickle shaped.—Obs. Annual. A very distinct species found in blossom in June, at the foot of the Catskill mountains, in woods."

most ones are quite entire. Although the seeds are in every case fully winged all around, the breadth of the wing differs greatly.

Var. *Burkii* was first collected by Isaac Burk in 1852 and was named in his honor by T. C. Porter. It was raised to specific rank by Small¹ in 1933 but, since it differs from *A. laevigata* only in two secondary characters, I cannot consider it other than a localized geographical variety of that species. Its cauline leaves are quite sessile and are linear to linear-lanceolate, while those of typical *A. laevigata* are amplexicaul or subamplexicaul and lanceolate to oblong-lanceolate. Its siliques are one-nerved to the middle or slightly beyond, but those of the typical form of the species are one-nerved only about one-third their length. It occurs only in the Allegheny Mountains from Pennsylvania south to North Carolina, although Small says of *A. Burkii*: "various provinces N. of Coastal Plain, N. Car. to Mo., & Vt."²

A. serotina Steele appears to me to be merely a much branched, late flowering form of var. *Burkii*. All attempts to find characters on which to separate the two plants have failed, although Steele says:

This plant was at first taken to be *Arabis laevigata burkei* Porter, which it resembles in several particulars of the description, but Doctor Rose, who kindly compared a specimen with Porter's material at the New York Botanical Garden, thinks the two are not the same. In any case, it is out of the question to refer this in any way to *A. laevigata*. Even if we disregard the fact that it is in perfectly normal bloom the middle of August while *A. laevigata* blossoms in April or May, the differences are fully of specific worth. The most striking are in the small flowers of the present plant, its narrow, nonsagittate, leaves, its more slender and woody stems, and its numerous spreading branches.³

The "differences" are almost impossible to ascertain. The flowers of the Steele plant seem in no way to be smaller than those of either the typical form of *A. laevigata* or of var. *Burkii* (although Steele emphasizes their small size), nor are the seeds of his plant, as far as I can discern, any larger than those of the other two, as he indicates. The only real differences apparent to me are that *A. serotina* at Steele's station (and all of his specimens in the United States National Herbarium were collected at one station) possesses a much branched habit and blooms later than any other plant of *A. laevigata* which has been observed in the course of this investigation. There are, in the Gray Herbarium, three specimens from the herbarium of Miss Lena Artz which were collected by her in the Massanutten Mountains of

¹ Small, Man. Fl. Se. U. S. 572 (1933).

² Small, l. c.

³ Steele in Contr. U. S. Nat. Herb. xiii. 365 (1911).

Shenandoah County, Virginia, and which show considerable branching, although by no means as much as that of the Steele specimens, and which bloom in July. She says of her collection:

An Arabis.—On May 24, 1934, I found on the shale banks near New Market in Shenandoah County, a small plant, then about two inches in height, which looked as if it were one of the Cruciferae. I planted two of the plants in my garden and in July when the plant began to bloom, I made another trip to the shale banks to collect it. The plant looked definitely like an *Arabis*. Of the species of *Arabis* in Gray's Manual it resembled most *A. laevigata* (Muhl.) Poir. However, its leaves were not arrow-shaped at the base; they were much narrower than the leaves of *A. laevigata*. The plant was just beginning to flower July 15, while *A. laevigata* has a much earlier flowering season, and the flowers were noticeably smaller than those of *A. laevigata*.

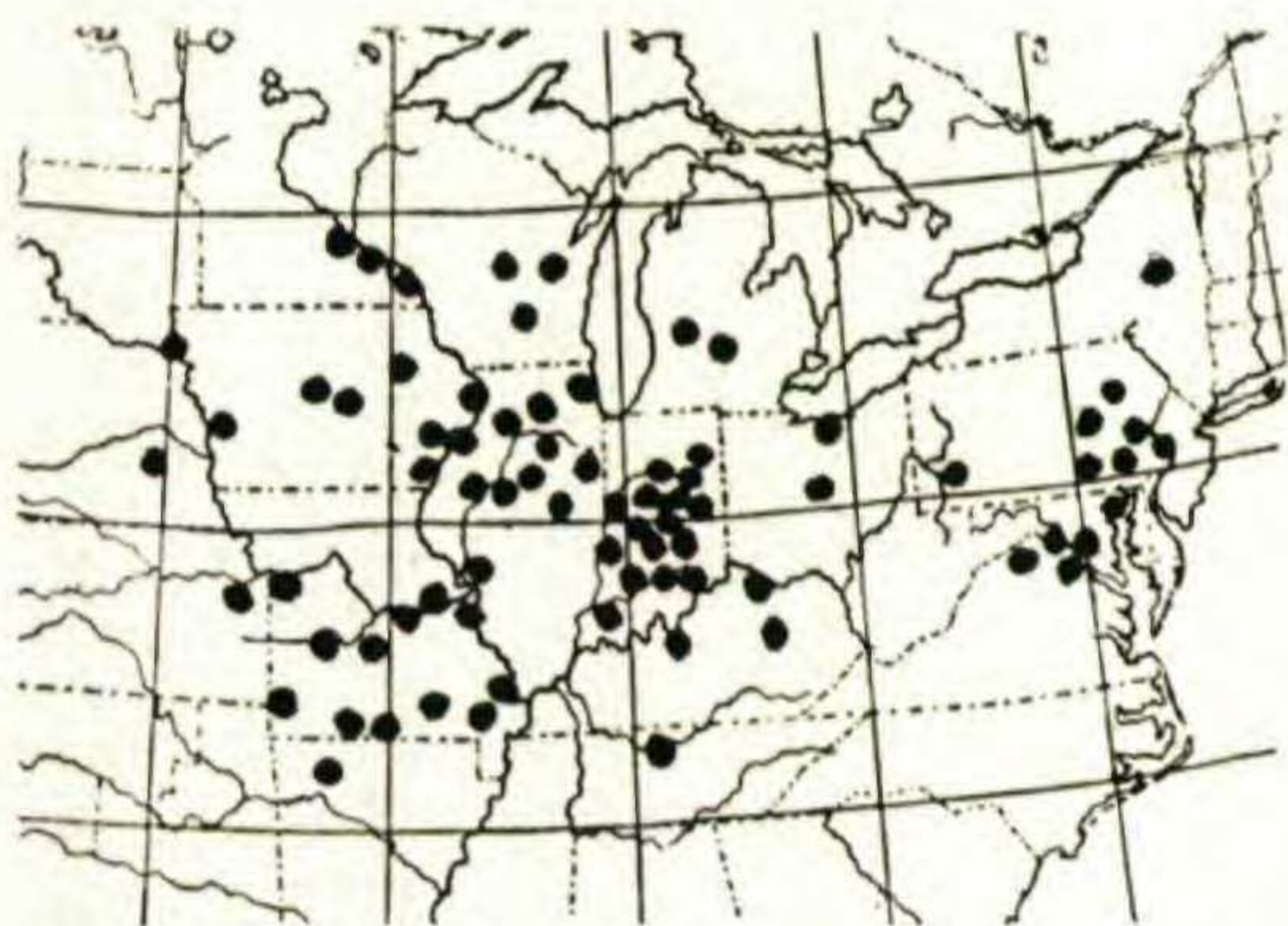
I sent several plants to the National Herbarium and Mr. E. C. Leonard checked them as *Arabis laevigata* . . . The plant seemed to me to resemble *A. serotina* Steele in Britton and Brown. I sent specimens to Dr. Wherry of the Department of Botany at the University of Pennsylvania. He checked the plant as *A. serotina* Steele.¹

But again, I can view these plants of Miss Artz' only as var. *Burkii*. The flowers of *A. laevigata* and of var. *Burkii* vary from 3 to 5 mm. long, and as those of the Artz specimens slightly exceed 3 mm., they are quite within the limits of the two above-mentioned plants.

14. *A. DENTATA* (Torr.) T. & G. Biennial from a simple tap-root: stem branching at base or rarely from the top or simple, ascending 2–6 dm. high, leafy, pubescent throughout with appressed to subappressed simple or forked hairs, green: radical leaves spatulate or obovate to oblanceolate, 4–15 cm. long, 1–4.5 (–6) cm. broad, acutish, petiolate, irregularly dentate to sinuate or very rarely lyrate-pinnatifid, finely and evenly stellate-pubescent on the lower surface, strigose to strigillose on the upper surface; cauline leaves oblanceolate to lanceolate or narrowly obovate, 1–6 cm. long, 0.5–2.5 cm. broad, imbricate to subimbricate, sessile with an amplexicaul base, irregularly dentate or more rarely sinuate, acutish, finely and evenly stellate-pubescent on the lower surface, strigillose to glabrous on the upper surface: flowers very small, in rather close racemes; flowering pedicels erect or ascending, 0.8–2 mm. long at anthesis, strongly hirsute with simple and forked hairs; sepals membranaceous, 1.5–2.5 mm. long, one-half the length of the petals, greenish, finely stellate-pubescent; petals white to cream-colored, 2–3 mm. long, narrowly oblanceolate to broadly linear: siliques 1.5–4 cm. long, 0.75–1.25 mm. broad, nearly straight or only very slightly curved, more or less finely stellate-pubescent on both surfaces with small stellate trichomes, divaricately spreading or slightly ascending, faintly one-nerved at the base or more often entirely nerveless; fruiting pedicels divaricately spreading or slightly

¹ Lena Artz in *Claytonia*, ii. 10 (1935).

ascending, coarsely pubescent with simple and forked trichomes, 2–3.5 mm. long at maturity; style short and stocky, 0.25–1 mm. long, often as broad as long; seeds oblong to subelliptical, in one row, wingless, averaging 1 mm. long, 0.5 mm. broad.—Fl. N. Am. i. 80 (1838); Eaton & Wright, N. Am. Bot. ed. 8: 130 (1840); Walpers, Rep. i. 133 (1842); Torrey, Fl. N. Y. i. 54 (1843); Dietrich, Synop. iii. 690 (1843); Wood, Classbk. ed. 2: 167 (1847); Gray, Man. 35 (1848); Chapman, Fl. So. States, 27 (1860); Britton & Brown, Ill. Fl. ii. 148 (1897); Britton, Man. 464 (1901); Small, Fl. Se. U. S. 484 (1903); Rydberg, Fl. Pr. & Pl. 382 (1932). *Sisymbrium dentatum* Torrey in Short, 3rd. Suppl. Cat. Pl. Kentucky, 338 (1833). *Iodanthus dentatus* Greene in Pittonia, iii. 254 (1897).—Shady banks and bottomlands or on limestone bluffs and ledges in rich woods, central New York to Minnesota and eastern Nebraska and Kansas, south to Virginia, Kentucky, Tennessee and Arkansas. The following are characteristic. NEW YORK: Utica, *Gray*. PENNSYLVANIA: York Furnace, lower Susquehanna R., *W. Stone*, no. 7,775 [Phil]; 2 mi. n. of Wrightsville, York Co., *Small*, 2 May 1891 (as *A. patens*) [NY]; Aspinwall, Allegheny Co., *J. A. Schafer*, no. 1,505. MARYLAND: Bald Friar, Cecil Co., *J. J. Carter*, 29 May 1917 [NY]; along Potomac R., Cabin John, *Painter*, no. 572 [Mo]; rich alluvium along the Susquehanna R., Bald Friar, Cecil Co., *St. John & Long*, no. 8,070 [Phil]. DISTRICT OF COLUMBIA: *Crandall*,



MAP 27. Range of ARABIS DENTATA.

without date or number; alluvial ground, *Steele*, 4 May 1896 [Minn]. WEST VIRGINIA: Wheeling, *G. Guppenburg*, 28 May 1878 [NY]. VIRGINIA: in cedar woods, Cedar Creek, Middletown, *F. W. Hunnewell*, 14 May 1932 [Bklyn]; rocky banks, Difficult Run, vicinity of Great Falls, *Killip*, no. 7,028 (as *A. laevigata*) [US]; along the Potomac R., near mouth of Dead Run, Fairfax Co., *Killip*, no. 12,892 [Phil]. MICHIGAN: cool woods near Lansing, *Bailey*, 4 June 1886; shore of Grand River, near the Soldier's Home, Grand Rapids, *Wheeler*, without date or number; open woods, sw. of Grand Rapids, *C. W. Fallass*, 5 June 1897 [Minn]. OHIO: South Florence, Erie Co., *Moseley*, 14 May 1898; vicinity of Sandusky, *Moseley*, 24 May 1893 [Mo]; shaded bottomlands, Columbus, *Gleason*, 9 May 1905. INDIANA: White R., 2 miles south of Bedford, Lawrence Co., *Kriebel*, no. 1,621; flood plain of Flat Rock R., 1 mi. west of Flat Rock, Shelby Co., *Deam*, no. 23,171 [Deam]; wooded slope of ravine, 4 mi. north of Lafayette, *Deam*, no. 54,802 [Deam]. KENTUCKY: wooded mountain, Quire's Camp, *J. W. Singer*, no. 258 [US]; banks of Elkhorn Creek,

Short, 1860 [Mo]; sandy border of Ohio R., *Wildberger*; Lexington, *Short*, no. 75 [NY]. TENNESSEE: Nashville, *Gattinger*, April 1879 [Mo.]. WISCONSIN: Madison, Dane Co., *Gaea Melaas*, 1905; limestone cliffs east side of Lake Winnebago, *F. H. Smith*, no. 15; Pittsville, Wood Co., *Carl Colby*, nos. 4,486 & 4,491. ILLINOIS: rich woods and rock dens, Decatur, *Gleason*, no. 546 (as *Sisymbrium Thaliana*); woods along Desplaines River, Proviso, *A. Chase*, no. 1,292; wooded banks, Tazewell Co., *F. E. McDonald*, 3 May 1895. MINNESOTA: bluffs, Winona Co., *Holzinger*, May 1901 [NY]; near Lake City, *S. M. Manning*, 6 June 1884 [Minn]; wet places, Red Wing, *J. H. Sandberg*, May 1884 [Minn]. IOWA: Marshalltown, *Ball*, no. 492; sandy alluvial flat, west of Bayfield, Muscatine Co., *B. Shimek*, 7 May 1903; Council Bluffs, *Geyer*, no. 218 [Phil]; Vinton, *J. J. Davis*; Fayette, *B. Fink*, May 1894. MISSOURI: rich woods along limestone bluffs, Crowley's Ridge, Painton, Stoddard Co., *E. J. Palmer*, no. 43,904; rich woods, Vale, *Bush*, no. 4,932; rich rocky woods, Courtney, *Bush*, no. 7,923; moist banks, Sibley, *Bush*, no. 8,301 [US]. ARKANSAS: Forum, *Bush*, no. 14,476 [Mo]. NEBRASKA: woods, Lincoln, *Hedgecock*, 6 June 1900 [Mo]. KANSAS: woods, Miami Co., *Oyster*, 20 May 1883 [NY]; edge of field, vicinity of Congo, *R. Hoffman*, 28 March 1917 [Mo.]. SOUTH DAKOTA: open woods, Brule Creek, Union Co., *W. H. Over*, no. 17,226. *Fl.* April–May; *fr.* May–July. MAP 27.

Var. **phalacrocarpa**, n. var. Siliquis glabris.—Rich woods and shaded cliffs, Missouri, Iowa and Arkansas. The following are characteristic. MISSOURI: along shaded limestone bluffs of Osage River, St. Clair Co., *E. J. Palmer*, no. 35,650 (TYPE in Gray Herb.); Hematite, Jefferson Co., *Eggert*, 29 April 1896 [NY]; woods along Missouri R., 3 mi. w. of Alton, *Drouet*, no. 1,379; 7 mi. southeast of Pacific, Jefferson Co., *Steyermark*, no. 907 [Mo]; Carthage, Jasper Co., *E. J. Palmer*, no. 1,749 [Mo]; Jefferson Co., rocks on riverside, *Eggert*, [Mo]; Blue Lick, along bluffs, *Bush*, no. 13,444 [Mo]. IOWA: shaded woods, Blackhawk Co., *C. Russell*, 10 May 1898 [Mo]. ARKANSAS: common in woods, Newport, *Bush*, no. 1,378; *Dr. Pitcher*, without locality [Phil]. MAP 28.



MAP 28.
Range of
ARABIS
DENTATA, var.
PHALACRO-
CARPA.

One of the two fundamental characters of typical *Arabis dentata* is its pubescent siliques. These are always covered with very minute, stellate trichomes which may be observed even in the earliest stages of fruit. The second striking character of this plant is the pubescence of its leaves. The basal ones show very clearly two distinct types of pubescence, the lower surfaces being covered quite thoroughly and, usually rather densely with very fine, forked trichomes, while the upper surface has instead coarse, decidedly strigose hairs scattered

either in great abundance or rather sparingly. The cauline leaves exhibit the same characters but to a less degree. The stellate pubescence of the lower surface of a typical stem-leaf is less dense than that of a basal one, while its upper surface shows considerably fewer strigae and may not infrequently be practically glabrous.

It seems rather remarkable that this interesting form of pubescence has seemingly escaped comment in the past. Torrey & Gray undoubtedly noticed it, although they failed to describe it completely, for they say in their description of the plant, "the pubescence (particularly of the under surface of the leaves) short and rather scabrous."¹ This is probably some slight implication that the lower surface of the leaves is different from the upper.

The siliques of var. *phalacrocarpa* lack the minute pubescence so characteristic of the typical form of the species, although its leaves have the usual strigose type. It occurs locally in Iowa, Missouri and Arkansas.

15. A. HOLBOELLII Hornem. Biennial or more rarely perennial: stem erect, 2-6 dm. high, branched at the base or more rarely simple, first to 7th internode finely stellate-pubescent with minute bi- and trifurcate and branched appressed hairs, gradually becoming glabrate, usually glabrous beyond the 10th internode, or more rarely in shade forms, only the 1st and 2nd internode stellate-pubescent: radical leaves rosulate, narrowly obovate to oblanceolate, entire, 2-8 cm. long, 4-10 mm. broad, subacuminate to acute, minutely and densely stellate-pubescent on both surfaces with bi- and trifurcate hairs, tapering to short narrowly winged and stellate-pubescent petioles; cauline leaves oblong-lanceolate to narrowly oblong, remote to subimbricate, often subrevolute, entire, acute to subacuminate, 1.5-4 cm. long, 3-9 mm. broad, sessile with a subamplexicaul sagittate base, the lowermost finely and evenly stellate-pubescent, the middle ones less so, the uppermost nearly or quite glabrous or rarely in shade forms all the cauline leaves glabrous: flowers large and showy for the genus, mostly secund, in loose racemes, at first suberect, but soon becoming spreading; flower buds sparingly stellate-pubescent or very nearly glabrous; flowering pedicels sparingly stellate-pubescent with minute trichomes or more rarely glabrous, 4-6 mm. long, soon becoming spreading or slightly descending; sepals herbaceous, one-half the length of petals, oblong, sparingly stellate-pubescent with minute trichomes or more rarely glabrous especially in shade forms, 3-4.5 mm. long, 1-1.5 mm. broad, obtuse, purplish with a white or subhyaline margin; petals white to pinkish or lilac-purple, 7 (6.5-)-9 mm. long, 1.75-2.25 mm. broad at apex, the limb rather spreading, narrowly spatulate-ovate to spatulate-oblanceolate; siliques 3 (2.5-)-6 cm.

¹ Torrey & Gray, Fl. N. Am. i. 80 (1838).

long, 1.5–2 (–2.5) mm. broad, somewhat irregularly curved inward or outward or very rarely nearly straight, slightly reflexed or somewhat descending, mostly secund, glabrous, bluntish at apex or rarely sub-acuminate, prominently one-nerved only at base or slightly beyond, the nerve soon tapering into obscurity; fruiting pedicels short, sub-geniculate to geniculate, 4–9 (–11) mm. long at maturity, sparingly stellate-pubescent with minute trichomes or some of them glabrous; stigma sessile or on a very short style not exceeding 0.25 mm. long; seeds in one row at maturity, orbicular to suborbicular, narrowly winged all around, 1–1.5 mm.

in diameter.—Fl. Dan. xi. t. 1879 (1828); Walpers, Repert. i. 132 (1842); Dietrich, Synop. iii. 693 (1843); Lange, Consp. Fl. Groenl. 49 (1880); not *A. Holboellii* of many American authors. *Turritis patula* Graham var. β Hooker in Fl. Bor.-Am. i. 41 (1829).—Greenland, Quebec and the Great Lakes region. The following are characteristic.

GREENLAND: Upernavik, Gnejs. 71° 15' N., *Porsild & Porsild*, 14 July 1929; Umanaq Storoe, Paornat, 70° 41' N., *Porsild & Porsild*, 8 July 1929; S. Disko, 69° 15' N., *R. T. Porsild*, 26 June 1929; Scoresby Sund, *N. Hartz*, 16 July 1891 [Can].

QUEBEC: dry rocky bluff near Rivière du Gouffre above Baie St. Paul, Charlevoix Co., *Stebbins*, no. 798; rocker, Bic, Rimouski Co., *Rousseau*, no. 28,830 (as *A. Collinsii*); cold

and shaded limestone and limestone conglomerate ridges from Pointe aux Corbeaux to Cap Caribou, *Bic, Fernald & Collins*, no. 1,061; colline au sud de la propriété d'Etienne Doucet, *Bic, Rousseau*, no. 26,919; Cap aux Corbeaux, sur le conglomérat nu, *Rousseau*, no. 26,440; moist open cliff on peak at southern end of Lake Matane on the west side, Matane Co., *J. H. Pierce & W. H. Hodge*, no. 15A; talus of calcareous cliffs near Cap Rosier, Gaspé Co., *Pease*, no. 20,209. ONTARIO: Ferguson Mt., Temagami Forest Reserve, *W. R. Watson*, no. 976 [Wisc]. MICHIGAN: wind-swept crests, crevices and talus of sandstone conglomerate, West Bluff, Keweenaw Co., *Fernald & Pease*, no. 3,334; rocky shore near Agate Harbor, Keweenaw Penin-



MAP 29. Range of *ARABIS HOLBOELLII*.

sula, *Pease & Ogden*, no. 25,181. *Fl.* June–Aug.; *fr.* July–Sept. MAP 29.

A. Holboellii, although actually having a very limited occurrence in North America, has long been treated as a Rocky Mountain species with outlying stations in Greenland, and almost every *Arabis* which possesses reflexed siliques and a stellate type of pubescence has been, at one time or another, referred to it. In reality, however, the plant is limited to the coasts of Greenland as far north as latitude 72°, and to very local stations in Charlevoix, Rimouski, Matane and Gaspé Counties, Quebec, as well as on the Keweenaw peninsula in Michigan and on Mt. Ferguson in the Temagami Forest Reserve of Ontario. It is quite distinct from any cordilleran species of *Arabis* and is quickly distinguished by its long petals (7–9 mm.) which have a very broad claw (1.75–2.25 mm.), cauline leaves never revolute or at most only very rarely subrevolute, and only slightly refracted siliques mostly secund and prominently one-nerved only at the extreme base. In the pubescence of its stem, however, it is like the cordilleran *A. retrofracta* Graham, both plants having a fine, minutely hoary, stellate pubescence which gradually disappears towards the top, although the pubescence of the basal leaves of the two plants is somewhat different, that of *A. retrofracta* being pannose or subpannose, while that of *A. Holboellii* is merely finely and evenly, but not densely, stellate. The characters above given, however, serve to separate our plant from that of Graham, although the two have usually been treated as synonymous. Thus, Frye & Rigg, in their Northwest Flora, give *A. retrofracta* as a synonym for *A. Holboellii* (p. 190), Piper lists *A. Holboellii* with *A. retrofracta* as a synonym (Fl. Washington, p. 293), and many other authors have treated the two species as identical. Such reductions have been the source of much difficulty in mapping the distribution of the plant, and have caused such a careful student as Porsild to state the range: "south of this latitude [in Greenland, 64°] only a single specimen is known from about 61°. In spite of this it must be stated as a decided southern type according to its occurrence in America."¹ And Porsild, following his predecessors, cites *A. retrofracta* as a synonym.

Greene appears to have been the first American botanist to realize that the Hornemann plant, which is exquisitely illustrated in *Flora Danica*, the plate being drawn from the type specimen,² was distinct

¹ M. P. Porsild, Fl. Disko Island, 83 (1926).

² Hornemann, *Flora Danica*, xi. t. 1879 (1828).

from that of cordilleran North America. He discusses the matter as follows:

I have made repeated careful and laborious efforts to ascertain to what extent genuine *Arabis Holboellii*, a Greenland plant as to the original, is indigenous to British America and the United States. And while the results attained can not be considered final, I think it well to put them on record.

And for one thing, I am convinced that *A. Holboellii* does not occur, so far as known, upon United States territory; nor have I yet met with satisfactory evidence of its occurrence on this continent; although it is to be expected from very far northward, along the shores of the Arctic seas. Our Rocky Mountain and other far western and northwestern plants that have been so referred must, it seems to me, be treated as fair subspecies at the least. A number of segregates have already been proposed, and I shall here present the characters of several more.

But first of all, I shall attempt, what seems never yet to have been given, a real diagnosis of the original of this group, which has hitherto been recognizable only by means of the plate in the *Flora Danica*.¹

His description of *A. Holboellii* "drawn from Greenland material in the herbarium of Mr. Theo. Holm"² is clear and concise and following it is one of *A. retrofracta* Graham, which brings out the essential differences between the two plants. Although I have not seen Macoun's no. 18,110, which is cited by Greene as being typical of *A. retrofracta*, nos. 18,109 and 18,108 (collected at Crows Nest Pass, Rocky Mts. on July 28th and 29th, 1897, no. 18,110 having been collected from the same station in August of that year) are in the herbarium of the National Museum of Canada, and are before me at the present moment. These two plants possess the fine and hoary stellate pubescence of the stem so typical of the Greenland plant, and if Macoun's no. 18,110 is at all similar, it is not clear why Greene regards it as being "more hirsutulous than stellate-hairy."³

The occurrence of *Arabis Holboellii* in Quebec is decidedly local; so rare is the plant in that region that comments such as "A second treasure was true *Arabis Holboellii* Hornem., the second collection of the typical plant outside Greenland, the first being on calcareous cliffs east of Bic,"⁴ and: "On this gravelly slope [near Baie St. Paul in Charlevoix Co.] was an abundance of my most interesting 'find', *Arabis Holboellii* Hornem. This is the third station for this species in Quebec. The other two stations, at Bic and at Cap Rosier at the

¹ Greene, *Pittonia*, iv. 187 (1900).

² Greene, l. c. 188.

³ Greene, l. c. 188.

⁴ Pease in *RHODORA*, xxxi. 55 (1929).

tip of Gaspé, are both much farther north and in areas which escaped Wisconsin glaciation. It is, consequently, interesting that, in his study of Pleistocene deposits about Baie St. Paul, Coleman should have found that 'the proofs of Wisconsin glaciation are confined to the valley and do not extend to the mountains which rise above it to the east and west.'¹ The evidence that stations for this species in Quebec have been untouched by Wisconsin glaciation has been thoroughly discussed by Fernald² and needs no amplification here. Regarding the Ontario and Michigan stations, moreover, it seems quite likely that the latter escaped Wisconsin ice and, although I can find no evidence regarding the former, it seems evident, in view of the fact that the other stations for *A. Holboellii* outside of Greenland are in regions thought to have escaped Wisconsin ice, that the Mt. Ferguson station may also have remained undenuded. Fernald says of the Michigan habitat: "Similarly, on the Keweenaw Peninsula evidences of extensive and profound work by glaciers were obvious at many low levels; but at the higher levels, such as West Bluff [where *A. Holboellii* was collected], 735 feet (224 m.) above Lake Superior, where the deeply weathered trap and conglomerate cliffs stand well above the levels of evident glacial till and denudation, subaerial decay and weathering have obliterated any apparent traces of glaciation, if there ever were any. . . . It is significant, then, that Keweenaw County has a greater assemblage of remotely isolated relic-species and isolated endemics than any other botanically explored region between the Gaspé cliffs and mountains and the Driftless Area of Wisconsin, Minnesota, Iowa and Illinois."³ He considers a conservative group consisting of "veteran" plants which are found in Greenland, in the Upper Great Lakes region and in other scattered regions of the northeastern part of this continent. It is in this class that *A. Holboellii* belongs, and if one can visualize its range before the Wisconsin ice as extending over a very broad area between Greenland and the Great Lakes, one can easily understand how its present-day stations in recently unglaciated regions, came about—simply because at these points the glaciers did not touch it, but left it to survive as a relic of a much more wide dispersal in previous times.

That Hooker's var. "β" of *A. patula* is merely our plant seems obvious from his comment "Professor Hornemann has sent me the

¹ Stebbins in RHODORA, xxxiv. 68 (1932).

² Fernald in Mem. Am. Acad. xv. 239-342 (1925).

³ Fernald in RHODORA, xxxvii. 204-205 (1935).

var. β from Greenland,"¹ Moreover, Mr. C. A. Weatherby has very kindly examined the specimen in the herbarium at Kew to which Hooker referred and assures me that it is an excellent match for *A. Holboellii* in every detail.

16. *A. CANADENSIS* L. Biennial, from a thick tap root: stem erect, tall, 3–9 dm. high, simple or more rarely sparingly branched above, sparsely hirsute at base usually with simple, more rarely bifurcate hairs, passing to entirely glabrous above: basal leaves soon disappearing, obovate to lanceolate, 2.5–13 cm. long, 1.5–4 cm. broad, serrate-dentate to slightly runcinate, hirsute on both surfaces especially along the midrib with simple and bifurcate hairs or more rarely entirely glabrous, petioled; cauline leaves imbricate to subremote, oblong-lanceolate to elliptic, 2.5–12 cm. long, 0.5–2.5 cm. broad, attenuate to a sessile or subsessile base or the lowermost short-petioled, acuminate, denticulate or more rarely subentire, lowermost villous-hirsute, uppermost hirsutulous with simple and forked hairs to entirely glabrous: flowers small, the lowermost often pendulous, in very long loose racemes; flowering pedicels 7–10 (–12) mm. long at anthesis, glabrous or often hirsutulous with simple hairs, erect at youth but becoming pendulous at anthesis; sepals 2–4 mm. long, 1–1.25 mm. broad, membranaceous, acute or obtuse, yellowish or purplish, hirsutulous with simple and bifurcate hairs, only slightly shorter than the petals; petals white to cream, narrowly oblanceolate to oblong, 3–5 mm. long: siliques falcate to arcuate, never straight, pendulous or recurved, 7–10 cm. long, 2.5–4 mm. broad, attenuate to subattenuate, glabrous, distinctly one-nerved to the top or slightly below the top, prominently reticulate-veined; fruiting pedicels slender, at first divaricate or ascending, deflexed and subgeniculate at maturity, hirsutulous to glabrous, 8–12 (–15) mm. long at maturity; stigma small, on a style 0.5–1 mm. long, never sessile; seeds in one row in the pod, averaging 1.25 mm. in diameter, orbicular to broadly elliptical, broadly winged all around except at the base where the wing becomes cordate, the wing averaging 0.75 mm. broad.—*Sp. Pl.* ii. 665 (1753); *Lam. Dict.* i. 121 (1783); *Persoon, Synop.* ii. 205 (1807); *DC. Syst.* ii. 238 (1821); *Delessert, Icon. Select.* ii. 9, tab. 29 (1823); *Elliott, Bot. S. Car. & Ga.* ii. 143 (1824); *DC. Prod.* i. 147 (1824); *Torrey, Compend.* 250 (1836); *Hooker, Fl. Bor.-Am.* i. 43 (1829); *Beck, Bot. N. & M. States*, 30 (1833); *T. & G. Fl. N. Am.* i. 82 (1838); *Eaton & Wright, N. Am. Bot.* ed. 8: 130 (1840); *Darby, Bot. So. States*, pt. ii. 21 (1841); *Walpers, Repert.* i. 133 (1842); *Dietrich, Synop.* iii. 694 (1843); *Torrey, Fl. N. Y.* i. 55 (1843); *Wood, Classbk.* 39 (1845); *Gray, Man.* 36 (1848); *Chapman, Fl. So. U. S.* 28 (1860); *Provancher, Fl. Canad.* i. 45, figs. 31–33 (1862); *Watson in Gray, Synop. Fl. N. Am.* i. 162 (1895); *Britton & Brown, Ill. Fl.* ii. 149 (1897); *Britton, Man.* 464 (1901); *Robinson & Fernald in Gray, Man.* ed. 7: 438

¹ Hooker, *Fl. Bor.-Am.* i. 41 (1829).

(1908); Rydberg, Fl. Pr. & Pl. 382 (1932); Small, Man. Se. Fl. 572 (1933). *A. falcata* Michx. Fl. Bor.-Am. i. 31 (1803); Poir. Encycl. Supp. i. 414 (1810); Pursh, Fl. Am. Sept. ii. 437 (1814); Bigelow, Fl. Bost. ed. 2: 251 (1824). *A. mollis* Rafinesque in Am. Month. Mag. ii. 43 (1817), non Steven in Bull. Soc. Nat. Mosc. iii. 270 (1812).—Rich woods, thickets or rocky banks, New England to Minnesota, south to Georgia and Texas. The following are characteristic. MAINE: Skowhegan, Somerset Co., *Furbish*, 3 July 1903. NEW HAMPSHIRE: Nottingham, *A. A. Eaton*, 1896. VERMONT: dry woods along West River, Brattleboro, Windham Co., *L. A. Wheeler*, 19 Aug. 1915; Manchester, *Blanchard*, no. 35; rocky woods, Pawlet, *Weatherby*, 8 June 1935. MASSACHUSETTS: steep rocky wooded slopes, North Adams, *Fernald & Long*, no. 9,569; rocky woods, Chelmsford, *Knowlton*, 13 June 1903; Lexington, *E. F. Williams*, 19 Sept. 1897. RHODE ISLAND: Providence, *Olney* [NY]. CONNECTICUT: rocky woods, Franklin, *Woodward*, 6 June & 19 July 1906; rocky woods, Southington, *Bissell*, no. 61; Wethersfield, *C. Wright*, 1878; Greenwich, *L. M. Stabler*, 26 June 1886. NEW YORK: west end of Beebe Lake, Ithaca, Tompkins Co., *E. L. Palmer*, no. 589; dry rocky woods above falls, Taughannock Ravine and vicinity, Ulysses, Tompkins Co., *A. J. Eames*, no. 4,220; calcareous soil, Haynes Hill, southern West Fort Ann, Washington Co., *Burnham*, 2 July 1920. NEW JERSEY: vicinity of Clifton, Passaic Co., *G. V. Nash*, 19 June 1890 [US]; rich woods along Otter Brook west of Somerdale, *H. B. Meredith*, 27 May 1921; along old wood road on slope of Second Mt., Watchung, Somerset Co., *Moldenke*, no. 1,692 [US]. PENNSYLVANIA: mountains, East Dauphin, *Small*, 30 June 1888; Easton, *A. A. Tyler*, 23 July 1896 [NY]; Erie, *Kuntze*, 8 Aug. 1874 [NY]; vicinity of McCall's Ferry, York Co., *Rose & Painter*, no. 8,116a [US]. DELAWARE: loamy wooded slopes, Guyencourt, Newcastle Co., *Long*, no. 27,530 [Phil]; loamy wooded slope, Mermaid, Newcastle Co., *Long*, no. 28,280 [Phil]. MARYLAND: Plummer's Island in Potomac R., near Cabin John, Montgomery Co., *Kearney & Maxon*, no. 65 [US]; rocky woods, Garrett Co., *J. D. Smith*, 7 July 1882 [US]; wooded slope along Susquehanna R., Conowingo, Cecil Co., *Long & Bartram*, no. 1,266 [Phil]; Cromley's Mount, Oakwood Township, *Pennell*, no. 1,583 [Phil]. DISTRICT OF COLUMBIA: in vicinity Washington, *L. F. Ward*, 24 May 1877; woods, *Steele*, 10 June & 14 July 1896 [Minn]; Prince Mill, *D. L. Topping*, 4 August 1896 [Minn]. WEST VIRGINIA: near Varney School, Mingo Co., *Berkley*, 8 July 1930; Snowy Mt., Pendleton Co., *Core*, 13 Aug. 1931 [NY]. VIRGINIA: Bedford Co., *A. H. Curtiss*, 9 June 1871; Mountain Lake, *Brown, Britton, Hogg et al*, 1 June 1890 [NY]; Walker Mt., vicinity of Marion, Smyth Co., *Brown, Britton & Vail*, 1 June 1892 [NY]; Peaks of Otter, Bedford Co., *Rydberg*, no. 9,267 [NY]. NORTH CAROLINA: dry woods near Waynesville, *Biltmore Herb.* no. 1,241b; Asheville, *B. L. Robinson*, no. 68; on ledge, upper slope, Bald Mt., *Hodgdon & Rossbach*, no. 74; dry banks, Swain Co., Great Smoky

Mts., *Beardslee & Kofoid*, 20 July 1891. SOUTH CAROLINA: summit of Paris Mt., *Small*, July 1896 [NY]; Andersonville, *F. E. H.*, 1886 [US]; Santee R. bottom, w. of St. Paul, Clarendon Co., *W. Stone*, no. 613 (as *A. lacvigata*) [Phil]. GEORGIA: on limestone rocks in rich woods near Grier's Cave, Randolph Co., *R. M. Harper*, no. 2,229; dry woods near Oconee River, Athens, *Harper*, May 1897 [NY]; Wilkes Co., *Chapman*, 1883 [NY]. ONTARIO: gravelly hillside, Port Stanley, Lake Erie, *Macoun*, no. 11; dry open rocky woods, Niagara Falls, *Macoun*, no. 1,659 [Can]. Amherstburgh, *Macoun*, no. 33,777 [Can]; on rocks, Lincoln Co., *McCalla*, no. 43 [Can]. MICHIGAN: woods, Saugatuck, *Umbach*, 27 July 1898 [US]; Jackson Co., *S. H. & D. R. Camp*, 12 June 1897 [Minn]; dry sandy soil, Grand Rapids, *E. J. Cole*, 20 June 1894 [Minn]; dry wooded slopes, Ann Arbor, *Hermann*, no. 6,811. OHIO: Columbus, *Sullivant*, 1840; Brady Lake, Portage Co., *L. S. Hopkins & R. J. Webb*, no. 1,253; near Cincinnati, *T. G. Lea* [Phil]; Sylvania, Lucas Co., *L. R. Wilson*, no. 1,476 [Wisc]. INDIANA: rocky soil on top of "knob," 3½ mi. nw. of New Albany, Floyd Co., *Deam*, no. 23,272 [Deam]; Lake Maxinkuckee, *B. W. Everman*, no. 824 [NY]; sandy open black-white oak woods, 1 mi. e. of Mongo, *Deam*, no. 20,703 [Deam]. KENTUCKY: hillside woods west of Olive Hill, Carter Co., *Weatherby & Weatherby*, no. 6,387; Star Limeworks and Bluff Spring, Lyon Co., *Eggleston*, no. 4,667 [NY]; Rockdale, *R. Runyon*, no. 1,308 [US]. TENNESSEE: woods, Sherwood, Franklin Co., *Eggert*, 8 June 1897 [Mo]; border of thickets, Knoxville, *Ruth*, no. 355; Lavergne, Rutherford Co., *Svenson & Shaver*, no. 6,939. ALABAMA: exposed sandstone cliff in gorge of Rocky Branch near Scales, Tuscaloosa Co., *Harper*, no. 3,054 [NY]; wooded hilltop, Birmingham, *Earle*, 24 May 1901 [NY]; Auburn, *Earle & Baker*, 29 May 1897 [Minn]. WISCONSIN: wooded sandstone bluff above Beef Slough, Alma, Buffalo Co., *Fassett & Hotchkiss*, no. 2,947; Boscobel, *H. E. Hasse*, 12 June 1884 [NY]; cascades of Bay Settlement, Brown Co., *J. H. Schuette*, 28 June 1881 [US]. ILLINOIS: black-jack association, Havana, *H. A. Gleason*, 17 Aug. 1904; open dry woods, Peoria, *F. E. McDonald*, Aug. 1904; copse near Wady Petra, Stark Co., *V. H. Chase*, no. 641 [Phil]. MINNESOTA: Jordan, Scott Co., *C. A. Ballard*, no. B196 [Minn]; wooded north slope of Zumbo Valley, near Thielman, Wabasha Co., *Butters & Rosendahl*, no. 3,531 [Minn]; Winnebago Valley, Houston Co., *H. L. Lyon*, 16 June 1899 [Minn]. IOWA: rocky woods, Fayette, *Fink*, June 1894; upland woods, Decatur Co., *Fitzpatrick & Fitzpatrick*, 26 May 1898 [NY]; Fort Dodge, *M. P. Somes*, no. C3,319 [US]. MISSOURI: Meramec Highlands, *H. A. Gleason*, 25 June 1904; Allenton, St. Louis Co., *Churchill*, 20 May 1918; rocky soil, Courtney, *Bush*, no. 7,985 [US]. ARKANSAS: Bethesda Springs, *H. C. Benke*, no. 5,493; dry woods near summit of West Mt., 3 mi. w. of Hot Springs, Garland Co., *R. M. Harper*, no. 31; Benton County, *E. N. Plank*, 1899 [NY]. NEBRASKA: Weeping Water, *M. E. Day*, no. 2; Nebraska City, *H. J. Webber* [NY]; Bad Lands, *Hayden*, 5

July 1853 [Mo]. KANSAS: rocky woods, Riley Co., *A. S. Hitchcock*, no. 1,009; Fort Riley, *E. E. Gayle*, June 1892 [NY]; Atchison Co., *G. Scarborough*, 28 May 1886 [Bklyn]. OKLAHOMA: LeFlore Co., *T. R. Stevens*, 25 June 1931 [US]; Sapulpa, *Bush*, no. 1,196 [Mo]. TEXAS: sandy woods, very rare, Dallas, *Reverchon*, May 1876; sandy upland woods, Larissa, Cherokee Co., *E. J. Palmer*, no. 7,847 [US]; rocky woodlands, Morris Co., *Biltmore Herb.*, no. 1,241e [Deam]. *Fl.* April–June; *fr.* June–Sept.

This very distinct and readily identified plant has had a fairly calm taxonomic history. Michaux, however, described it as a new species, *A. falcata*,¹ and some subsequent authors used his name: Pursh, Nuttall and Bigelow. Michaux's type of *A. falcata* was studied in 1903 by Professor M. L. Fernald, whose notes indicate that it is identical with *A. canadensis* L. Rafinesque, writing in the American Monthly Magazine, described *A. mollis*, which is without a doubt merely *A. canadensis*. He says of it:

Stem upright, leaves sessile, lanceolate, acute, hairy, with remote teeth: flowers on long racemes and long peduncles, calyx hispid, petals cuneate obtuse, entire, longer than the calix, siliques drooping, sickle shaped compressed.—Obs. This species has perhaps been overlooked, being taken for a variety of *A. canadensis* or *A. falcata* of which it has the habit and fruit, but it differs widely by the leaves which are not smooth or hastated. It is more scarce, and grows in rocky woods on the Highlands, the Catskill mountains, and near Athens, Hudson, Fishkill, &c. Mr. Torrey has found it also on the Island of New-York; it blossoms in June and July. The stem rises without branches, from one to three feet, the leaves are thin and soft. Perennial. It varies with smooth and hairy stem, sometimes branched, and a variety has oblong leaves. The flowers have the glands as in *A. alpina*.²

A. canadensis does not possess either smooth leaves nor "hastated" ones, as implied by Rafinesque, nor is it ever a perennial, as far as I can discern, so that it is apparent that Rafinesque misinterpreted *A. canadensis*. His characterization of *A. mollis* so perfectly fits our plant that it seems clear that it is true *A. canadensis*. No other species of *Arabis* familiar to me from the Catskills and Highlands region possess "hairy" leaves and sickle-shaped siliques. In the discussion of *A. pycnocarpa* in this paper, I have stated that the plant which was perhaps the basis of Pursh's *Turritis ovata* is quite clearly *A. canadensis*; but whether *A. ovata* (Pursh) Poir. should be correctly placed as a synonym for *A. canadensis* can only be surely known when and if the type specimen of the Pursh plant is found. DeCandolle

¹ Michaux, *Fl. Bor.-Am.* ii. 31 (1803).

² Rafinesque in *Am. Mo. Mag.* ii. 43 (1817).

reduced it to a variety of *A. sagittata*,¹ and Torrey & Gray included it as a variety of *A. hirsuta*,² which they considered to be identical with *A. sagittata* DC. But I have felt that it was wiser to omit it from the synonymy of any species.

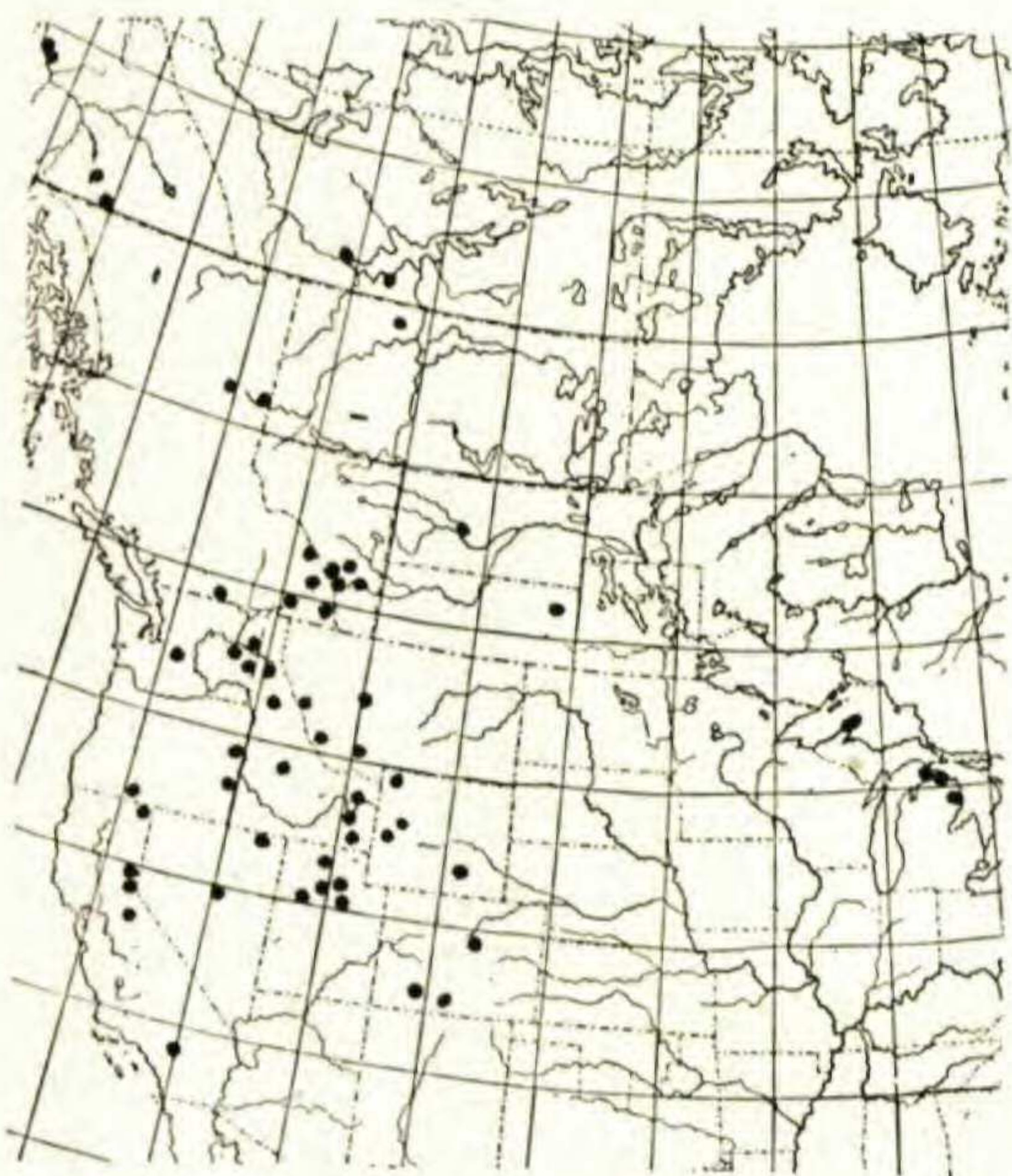
In the Herbarium of the United States National Museum there is a specimen from Oklahoma collected in LeFlore Co., by T. R. Stemen and supposed to be a hybrid of *A. canadensis* and *A. laevigata*. The plant appears to me to be typical *A. canadensis* in every detail except for the perfectly glabrous cauline leaves which lack the characteristic hirsute or hirsutulous pubescence of that species. The only character of *A. laevigata* which the specimen possesses is the glabrous leaves, but in the absence of further proof of its hybrid origin (such as cytological studies), I have treated it as ordinary *A. canadensis*.

17. *A. RETROFRACTA* Graham. Biennial or more rarely perennial; stem erect, simple or more rarely branched at base, the base finely hoary-pubescent with minute stellate trichomes, becoming less hoary upwards and passing to glabrous; radical leaves rosulate, narrowly obovate to oblanceolate, entire to denticulate, 2–5 cm. long, 3–9 mm. broad, subacute, pinnose to subpinnose on both surfaces with minute stellate trichomes, tapering to short narrowly winged minutely stellate-pubescent petioles; cauline leaves linear-lanceolate to lanceolate, imbricate to subimbricate, entire with distinctly revolute margins, 1.5–5 cm. long, 3–6 mm. broad, sessile with a subamplexicaul sagittate base, acuminate, the lowermost finely pinnose on both surfaces, the middle ones subpinnose or merely minutely stellate-pubescent, the uppermost nearly or quite glabrous; flowers at first erect but becoming reflexed at anthesis, in loose racemes; flower buds minutely stellate-pubescent or very rarely subtomentose; flowering pedicels minutely stellate-pubescent, 5–7 mm. long, soon becoming reflexed; sepals herbaceous, 2.5–4.5 mm. long, 1–1.5 mm. broad, oblong, one-half to one-third the length of the petals, finely stellate-pubescent with minute trichomes or more rarely nearly glabrous; petals white to pinkish or lilac-purple, 6–9 mm. long, 1–1.75 mm. broad at apex, narrowly spatulate-obovate; siliques straight or nearly so, narrow, 3.5–7 (–8) mm. long, 1–1.5 (–1.75) mm. broad, acute to acuminate, glabrous, strongly reflexed, appressed to subappressed, one-nerved prominently to middle or slightly beyond, the nerve quickly becoming obscure beyond there; fruiting pedicels 5–12 mm. long, strongly reflexed, geniculate to subgeniculate, finely stellate-pubescent with minute trichomes or some of them quite glabrous; stigma sessile or on a very short style not exceeding 0.25 mm. long; seeds mostly in one row at maturity, orbicular to suborbicular,

¹ DC., Syst. ii. 222 (1821).

² T. & G., Fl. N. Am. i. 80 (1838).

narrowly winged all around, 0.75–1.2 mm. in diameter.—Edin. New Phil. Journ. 344 (July–Oct. 1829); Howell, Fl. Nw. Am. i. 45 (1897); Greene, Pittonia, iv. 188 (1900); Rydberg, Fl. Rocky Mts., 362 (1917) and Fl. Pr. & Pl. 382 (1932). *Turritis retrofracta* Hooker, Fl. Bor.-Am. i. 41 (1829). *A. Holboellii* var. *retrofracta* Rydberg in Contr. U. S. Nat'l. Herb. iii. 484 (1896); Jepson, Man. Fl. Pl. Calif. 429 (1925), the combination erroneously ascribed to Jepson; Munz, Man. So. Calif. Bot. 205 (1935). *A. Kochii* Blankinship in Mont. Agri. Coll. Sci. Stud. i. 57 (1905).—Northern Michigan; Mackenzie and Yukon, south in the Mountains to Colorado and California. The following are characteristic. MICHIGAN: sands, north shore of Thunder Bay near



MAP 30. Range of ARABIS RETRO-FRACTA.

Alpena, *C. F. Wheeler*, 3 July 1895; wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., *Fernald & Pease*, no. 3,335; sand dunes of Big Stone Bay, Emmet Co., *Ehlers*, no. 501 (as *A. canadensis*). MACKENZIE: Mackenzie River, *I. S. Onion, R. Kennicott & W. L. Hardisty*, 1861–62 [NY]; rocky soil, Windy Point, Great Slave Lake, *G. S. Hume*, no. 102,665 [Can]. ASSINIBOIA: Assiniboia River railway survey, *Macoun*, no. 75. SASKATCHEWAN: junction of north fork and north branch of Saskatchewan River, *S. Brown*, no. 924 (as *A. Holboellii patula*). ALBERTA: Rocky Mt.

Park, Wapta Lake, *Macoun*, no. 64,511; Pine Lake District, Wood Buffalo Park, *Raup*, nos. 2,489 & 2,491; Banff, *Butters & Holway*, no. 52; Crow Nest Pass, lat. 49° 30', *Macoun*, no. 18,109 (as *A. patula*); Rocky Mts., Palliser's Brit. N. Am. Expl. Exped., *E. Bourgeau*, 1858 ["substitute type" in Gray Herb.]. MONTANA: dry gravelly bank, west fork of Rock Creek near Mud Lake, Ravalli Co., *C. L. Hitchcock*, no. 1,754; near Pony, *Rydberg & Bessey*, no. 4,227; vicinity of Helena, *B. T. Butler*, no. 1,854 [NY]. IDAHO: ridges south from Wiesner's Peak, Coeur d'Alene Mts., *Leiberg*, no. 1,404; Ketchum, *A. I. Mulford*, 24 June 1892; rather open slopes, Parker Mt., Custer Co., *Macbride & Payson*, no. 3,271 (as *A. lignifera*). WYOMING: Surveyor Park, Fremont Lake, Sublette Co., *Payson & Payson*, no. 2,817; gravelly sagebrush flat, Alpine, Lincoln Co., *Payson & Armstrong*, no. 3,401 (as *A. exilis*); Copperton, Carbon Co., *F. Tweedy*, no. 4,467 [NY]. COLORADO: South Park, *Wolf &*

Rothrock, no. 655 (as *A. patula*); Ojo, *Rydberg & Vreeland*, no. 6,179 [NY]; Mancos, *Eastwood*, June 1892 [NY]. UTAH: Salt Lake City, *O. A. Garrett*, no. 1,094; Logan, *A. I. Mulford*, no. 49 (as *Thelypodium micranthum*) [NY]; mountains southeast of Silver Lake, near the headwaters of Big Cottonwood Creek, *Rydberg & Carlton*, no. 6,564 (as *A. elegans*) [NY]; Bingham, *M. E. Jones*, no. 378. NEVADA: dry bottomlands, Jarbridge, *Nelson & Macbride*, no. 1,920 (as *A. exilis*); Palisade, alt. 5,000 ft., *S. G. Stokes*, 17 June 1903 [US]. CALIFORNIA: Soda Springs, *Brewer*, 1863 (as *A. patula*); lower end of Donner Lake, Nevada Co., *Heller*, 13 July 1903; cactus flat of Cushenbury Canon, *M. E. Jones*, 12 May 1926 [NY]; Bear Valley, San Bernardino Mts., *S. B. Parish*, no. 2,483 [NY]. OREGON: Swan Lake Valley, Klamath Co., *E. I. Applegate*, no. 29; mountain sides, Baker Co., *Cusick*, no. 1,080; near Harper Ranch, Malheur Co., *Leiberg*, no. 2,092 [NY]; summit of Blue Grass Ridge, Mt. Hood, alt. 4,500 ft., *J. W. Thompson*, no. 3,294 [Phil]. WASHINGTON: Spokane, *Piper*, no. 2,690; on mountains, west Klickitat Co., *Suksdorf*, May 1884 & July 1885 (as *A. canescens*); near Sprague, Lincoln Co., *Sandberg & Leiberg*, no. 139 [NY]; Spokane Valley, *Dr. Lyall*, 1861; Simcoe Mts., *Howell*, June 1881 [NY]. BRITISH COLUMBIA: Kicking Horse Valley, vicinity of Field, *S. Brown*, no. 351; shore of Howser Lake, *C. H. Shaw*, no. 711; dry bluffs, north bank of Peace R., at Taylor Flat, about 56° 8' N., 120° 40' W., alt. 6,000 ft., *Raup & Abbe*, no. 3,573; west and north-west slopes of Mt. Selwyn, about 56° 1' N., 123° 39' W., alt. 4–5,000 ft., *Raup & Abbe*, no. 3,958. YUKON TERRITORY: White Horse, *Macoun*, nos. 58,354, 58,358 & 58,359 [NY]; Hunker Creek, *Macoun*, no. 58,357 [NY]; Dawson, *Eastwood*, no. 134. *Fl.* late May–June; *fr.* June–July. MAP 30.

After a careful search in the herbarium of the Royal Botanic Garden in Edinburgh, Mr. C. A. Weatherby informs me that no type of Graham's *Arabis retrofracta* is to be found there, and adds that the only old specimen labelled "*A. retrofracta*" is one from the Palliser Expedition collected by Bourgeau in 1858. A duplicate of this Bourgeau plant is in the Gray Herbarium and pasted in one corner of the sheet is an envelope on which is written in Asa Gray's hand, "Pod of what is thought to be *Turritis retrofracta*. From Herb. Graham." This envelope contains one silique of a plant which is unquestionably an *Arabis* and which possessed reflexed pedicels, for there is enough left of the pedicel to show a geniculate condition indicative of a reflexed position on the stem. Its nervation and the characters of the mature seeds contained in the pod indicate that it came from a plant of what we now recognize as *A. retrofracta* but from what specimen it is impossible now to say. It is a perfect match for the siliques of the Bourgeau specimen, which is an excellent representa-

tive of the plant so lucidly described by Graham as *A. retrofracta*. Graham's description reads as follows:

Root branching, fibrous. *Stem* erect, scarcely branched, hoary, especially below, where also purplish, green above. *Leaves* soft and hoary on both sides, revolute in their edges, sessile, dilated at the base and stem, clasping; the lower leaves mostly hoary and purplish, entire or slightly toothed at the apex only, spathulato-linear, higher up lanceolato-linear, and towards the top subulate, entire and sagittate, those lower on the stem having small auricles. *Raceme* terminal, elongating while flowering; *pedicels* opposite, but frequently solitary (from abortion?), bent down, with a very acute angle at their origin, turned to one side, hairy, hairs branched. *Calyx* yellowish-green, leaflets elliptical, edges membranaceous, adpressed, half the length of the pedicel, sparingly covered with similar hairs. *Corolla* nearly as long as the pedicel, white, or with a very faint purple tinge; *petals* spathulate, somewhat oblique at the apex, and slightly emarginate. *Stamens* rather longer than the calyx, the longer exceeding the shorter by the length of the anthers; filaments colorless, smooth; anthers pale yellow. *Pistil* rather shorter than the stamens; germen linear, slightly swollen at its base, slightly compressed, much elongated before the flowers fall; style nearly wanting; stigma very small, blunt, simple, glandular only on its upper surface. Seeds arranged in a single row in each locument, bordered; cotyledons flat, embryo applied to their edges.

Raised at the Botanic Garden from seeds collected in Captain Franklin's last expedition. The station of the species is stated by Dr. Richardson to extend from Hudson's Bay to the Rocky Mountains, and from Canada to Lat. 68° at Mackenzie's River.

Because his description so adequately fits the plant of cordilleran and Pacific North America, although no actual type-specimen seems to exist, and because Hooker and subsequent authors well understood it, I am continuing to use Graham's epithet rather than discard it in favor of a new one and have cited the Bourgeau specimen as a "substitute type," in case the true type should come to light in the future. *A. retrofracta* is characterized by a minute stellate pubescence on the stem, which normally appears hoary. The radical leaves range from pannose to subpannose, the cauline leaves are lance-linear and very revolute, tapering to an acuminate apex; the flowers are large for the genus and somewhat secund; the sepals and flowering pedicels display the same minute (hoary) stellate pubescence as does the stem; and the siliques are long, straightish, narrow, and prominently nerved to the middle. In its pubescence the plant closely resembles *A. Holboellii*, although that of the latter is usually less pannose on the radical leaves, being merely minutely stellate.

Although a majority of American authors have consistently con-

fused our plant with the Greenland *A. Holboellii*, *A. retrofracta* has been correctly interpreted by Rydberg, by Greene and by Howell,¹ but each of them has emphasized certain characters not brought out by the others. The differences between the two plants have been stressed in the discussion of *A. Holboellii* and need not be rediscussed. *A. retrofracta* is a cordilleran species found eastward only in isolated and extremely local stations in northern Michigan, extending throughout the Rocky Mountain and Pacific coast regions. In southern California it is isolated in the San Bernardino Mountains, but this isolation is quite in accord with the present interpretation of endemism in that region.²

Although it appears quite probable that *A. lignipes* A. Nelson³ is a synonym for *A. retrofracta*, I have refrained from citing it in the formal bibliographical list because the type-specimen is unavailable to me at the present time. Several sheets from the immediate vicinity of the type-station, identified by Professor Nelson as *A. lignipes*, were kindly loaned to me by him, but until the actual type itself is seen, I ought not to say with certainty that it is *A. retrofracta*.

18. *A. PENDULOCARPA* A. Nelson. Perennial from a subligneous base: stem erect, slender, 1–3 dm. high, branched at base or above or more rarely simple, densely hispid or hirsute below with simple or bi- or trifurcate, spreading to subspreading hairs, passing above to loosely-hispidulous and glabrous: radical leaves densely rosulate, oblanceolate to narrowly obovate, acute to subacute, 1–5 cm. long, 4–10 mm. broad, entire to subdentate with a few scattered teeth near the apex, pannose on both surfaces with minute stellate trichomes, petiolate, the petioles hirsute to ciliate; cauline leaves lanceolate to narrowly oblong, acute to subacuminate, entire, remote to subimbricate or often entirely imbricate, sessile with an auriculate or a sagittate

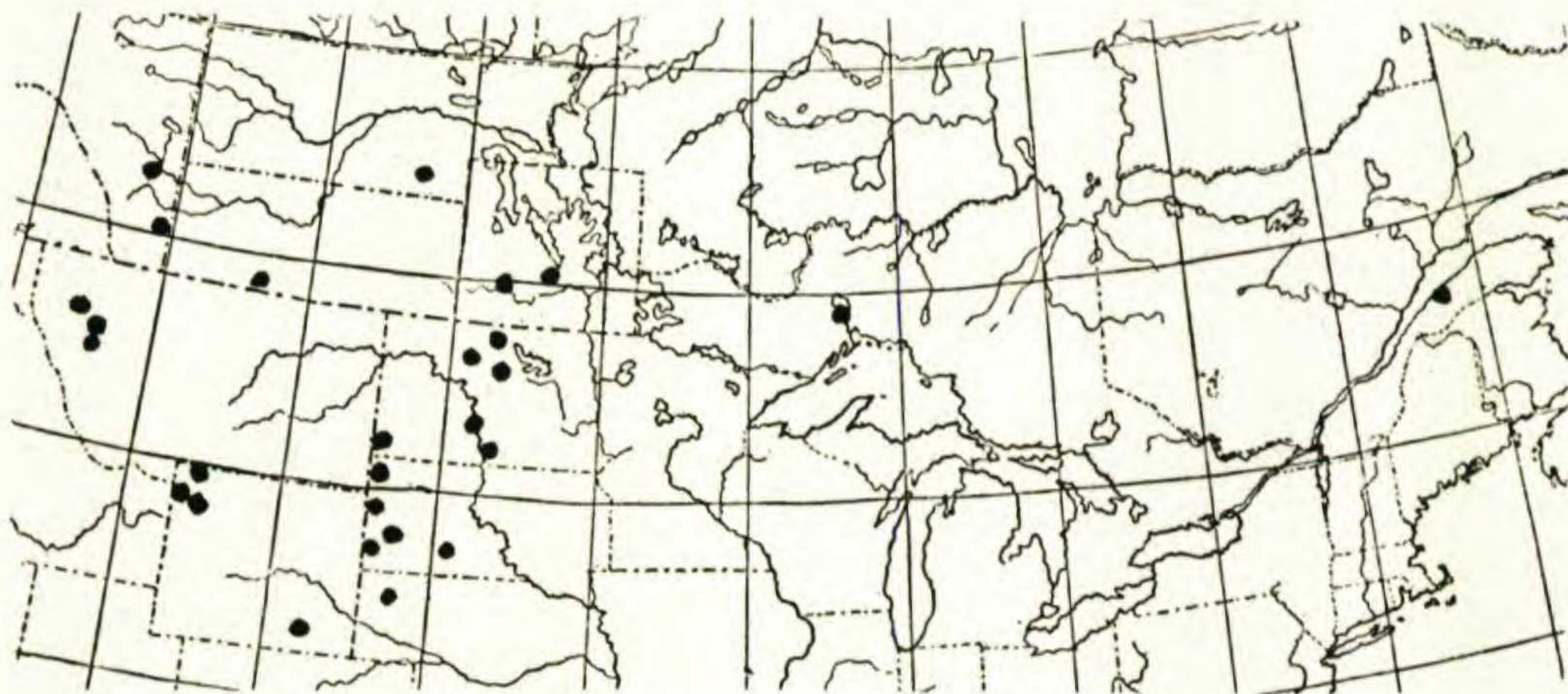
¹ Greene, discussing the plant in *Pittonia*, iv. 188 (1900) says: "I note that Mr. Howell, in his *Northwestern Flora*, has taken up the name *A. retrofracta*, but, as it appears from the description, for a plant very different from this [Graham's *A. retrofracta*]." Howell's description seems to tally in every respect with Graham's, even more closely in some ways than Greene's.

Rydberg, although at first considering the two species as so closely related that he treated *A. retrofracta* as a mere variety of *A. Holboellii* [*Contr. U. S. Nat'l. Herb.* iii. 484 (1896)], later realized that they were quite separate, and in his *Flora of the Rocky Mountains* (1917), and in his *Flora of the Prairies and Plains of North America* (1932) correctly interpreted *A. retrofracta*. Its occurrence in Nebraska, as cited by him in each book is, however, somewhat dubious. It seems more probable that specimens referred to that state were misidentified, especially as *A. pendulocarpa* (*A. Collinsii*) has been recorded from there, and as it is not difficult to confuse the two species unless they are clearly understood.

² For discussion of endemism in the Southern California flora see Munz, *Man. S. Calif. Bot.*, *Introd.* xv–xvi (1935).

³ A. Nelson in *Bot. Gaz.* xxx. 191 (1900).

base, revolute to subrevolute, 8–23 mm. long, 1.5–4.5 mm. broad, the lowermost subpannose to hirsutulous, the uppermost hirsutulous or frequently glabrate: flowers small, somewhat secund, in loose racemes; flowering pedicels hispidulous to glabrate, 5–7 mm. long at anthesis; sepals herbaceous, oblong, one-half to one-third the length of petals, 2–4 mm. long, 0.5–0.75 mm. broad, green or greenish with a white or slightly hyaline margin around the upper periphery, hispidulous to glabrate with simple and bifurcate hairs; petals white to pink or pinkish, narrowly spatulate-obovate to spatulate-oblongate, 3–6 mm. long, 1–2 mm. broad at apex: siliques straight or more rarely somewhat curved, glabrous, 2.5–5 (–6) cm. long, 1–1.5 mm. broad, acute to subacuminate, somewhat secund, reflexed at maturity, prominently one-nerved to the middle or rarely only slightly beyond; fruiting pedicels strongly refracted, subappressed to appressed, loosely



MAP 31. Range of ARABIS PENDULOCARPA.

hispidulous with simple and bifurcate hairs or often some of them quite glabrous, geniculate to subgeniculate, 6–12 (–15) mm. long at maturity; stigma round, small, on a short style usually 0.25–0.35 mm. long or quite sessile; seeds crowded somewhat in two rows, suborbicular to broadly oblong or very irregular in outline, 0.75–1.2 mm. in diameter, narrowly winged at apex or all around.—*Bot. Gaz.* xxx. 192 (1900); Rydberg, *Fl. Rocky Mts.* 363 (1917). *A. Collinsii* Fernald in *RHODORA*, vii. 32 (1905); Britton & Brown, *Ill. Fl.* ed. 2: ii. 183 (1913); Victorin, *Fl. Laurentienne*, 261 (1935).—Dry ledges, grassy hillsides and rocky thickets, Bic, Quebec; western Ontario to Alberta, south to northwestern Nebraska and Wyoming. The following are characteristic. QUEBEC: limestone-conglomerate cliffs and ledges, island headland east of Baptiste Michaud's, Bic, *Collins & Fernald*, 16–18 July 1904 [type of *A. Collinsii* in Gray Herbarium]; près du Cap Enragé, Bic, *Victorin*, no. 9,582; ledges, Bic, *Churchill*, 12 July 1905; sur le conglomérat nu, Ilet à d'Amours, Bic, *Rousseau*, nos. 26,600 & 26,611. ONTARIO: dry rocky places, trap rock, Black-

water R., Lake Nipigon, *Macoun*, no. 1,685 [Can]. MANITOBA: prairies north of Carberry, *Macoun & Herriot*, no. 69,860 (as *A. lignipes*) [Can]; Pine Creek, *Macoun & Herriot*, no. 69,859 (as *A. lignipes*) [Can]; dry open meadow near Insane Asylum, Brandon, *Macoun*, no. 12,371 [Can]. NORTH DAKOTA: Towner, McHenry Co., *J. Lunell*, 29 May 1908 [Phil]; Mandan, *J. T. Sarvis*, 1915 [US]; dry gravelly soil, Minot, *Olga Lakela*, no. 451 [Minn]; Dunseith, Rolette Co., *J. Lunell*, 4 June 1911 [NY]; in sandy soil on hillside, Cannon Ball, *H. F. Bergman*, no. 1,556 [Minn]; bluffs in Bad Lands, Marmarth, *L. R. Moyer*, no. 452 [Minn]. SOUTH DAKOTA: rocky shaded ledges, Custer Peak, Lawrence Co., *E. J. Palmer*, no. 37,545; Elk Canyon, Black Hills, alt. 4–5,000 ft. *Rydberg*, no. 520 [NY]; Redig, *J. W. Moore*, no. 1,535 [Minn]; hillsides, Mayo, Custer Co., *Over*, no. 1,849 [US]; grassy hillsides, Bear Creek, Washabaugh Co., *Over*, no. 2,087 [US]. NEBRASKA: Fort Robinson, *J. M. Bates*, 4 June 1890. SASKATCHEWAN: prairies, 12 Mile Lake, near Wood Mt., *Macoun*, no. 10,305 [Can]; dry thickets and in sparsely wooded country, Pheasant Plain, *Macoun*, no. 1,691 [Can]. MONTANA: exposed slope of Waterworks Hill, North Missoula, 3,600 ft. elev. *C. L. Hitchcock*, no. 1,592; barren gravelly ridge, 5 miles east of Parma, Sanders Co., *C. L. Hitchcock*, no. 1,551; dry rocky slope near second bridge above Bonner, Blackfoot Valley, Missoula Co., *C. L. Hitchcock*, no. 1,686. WYOMING: Mammoth Hot Springs, Yellowstone National Park, *F. Tweedy*, June 1885 [US]; Laramie, *A. Nelson*, no. 56 (as *A. Lemmoni*) [US]; on cliffs and rocky ledges, Madison, Yellowstone National Park, *A. & E. Nelson*, no. 5,504 [TYPE in Herb. Univ. of Wyoming]; Yellowstone River near Junction Butte, Yellowstone National Park, *A. & E. Nelson*, no. 5,738 [CO-TYPE in Herb. Univ. of Wyoming]. ALBERTA: dry grassy hills, Black Birch Coulee, vicinity of Rosedale, *M. E. Moodie*, no. 823 [NY]; Medicine Hat, *Macoun*, no. 3,073 [Can]. *Fl.* June–July; *fr.* June–Aug. MAP 31.

Arabis pendulocarpa is primarily a species of the northern Great Plains, extending into the Rocky Mountains of the United States and quite isolated at Bic, Rimouski County, Quebec, where it has been, since its discovery there in 1905, one of the many famous "relics" of that area. It is found around Lake Nipigon, in western Ontario, in the prairies of Manitoba, Saskatchewan and eastern Alberta, extending southward through North Dakota into the Black Hills of South Dakota and in extreme northwestern Nebraska, thence westward to Yellowstone National Park in Wyoming, and, locally in Montana. From west or south of Wyoming I can find no records of its occurrence, and all efforts to place it in the Canadian Rocky Mountains have likewise failed.

A. pendulocarpa is easily confused with *A. retrofracta* Graham,

from which it differs in its loosely hispid stem-pubescence and in its smaller flowers, and with the Greenland *A. Holboellii* (which also occurs at Bic), from which it is easily distinguished by the pannose pubescence of its radical leaves, its narrower petals (in *A. Holboellii* the petals are 1.75–2.25 mm. broad at the apex; in *A. pendulocarpa* they average 1.5 mm. broad), and its narrow, straightish siliques. The type-specimen of *A. Collinsii* Fernald matches Nelson's type of *A. pendulocarpa* in every detail.

EXPLANATION OF PLATES

PLATE 457. *A. HIRSUTA* (L.) Scop. FIG. 1, habit of plant, $\times 1$, from Bavaria, Germany, *Fischer*, 9 June 1900; FIG. 2, seeds, $\times 10$, from the same plant.

PLATE 458. *A. PYCNOCARPA* n. sp. FIG. 1, habit of plant, $\times 1$, from Bonaventure Co., Quebec, *Collins & Fernald*, July 19–20, 1904 (TYPE); FIG. 2, seeds, $\times 10$, from the same plant; FIG. 3, fruit of *A. PYCNOCARPA* and *A. HIRSUTA*, $\times 2$, the long fruit being from the type specimen of *A. PYCNOCARPA* and the short fruit from the Bavarian specimen of *A. HIRSUTA*.

NEW RECORDS FOR THE CONNECTICUT VALLEY IN MASSACHUSETTS

WAYNE E. MANNING

THE following plants, collected by the writer unless indicated otherwise, have not been previously reported from this part of Massachusetts, and in one case from the state. All identifications have been verified at the Gray Herbarium.

EQUISETUM PALUSTRE L. Growing in springy clay outcrop along the bank of the Connecticut River near Hadley; first collected June 6, 1931.

The plants are few in number, and are being crowded out by *Equisetum arvense* L., with which they are associated. No plants have been seen in fruit, though the area has been examined at several seasons during the year.

EQUISETUM HYEMALE L. var. *INTERMEDIUM* A. A. Eaton. Dry bank of the Connecticut River, near the old ferry crossing, Hockanum Road, Northampton, June 2, 1931.

The plants do not appear to be evergreen, possibly because the old shoots had been carried away in high water. *Equisetum pratense* Ehrh. grows nearby in the meadows with *E. arvense* L.

SAGITTARIA CUNEATA Sheldon (*S. arifolia* Nutt.). A small colony in a drainage ditch between the road and a drained marsh along the